ATTACHMENT 4

City of Imperial Beach
Bicycle Transportation Plan

Final Draft: March 2009

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Caltrans BTA Compliance

Bicycle Transportation Account - Code Section 891.2 Compliance

The Bicycle Transportation Account (BTA) funds projects that improve safety and convenience for bicycle commuters. To be eligible for BTA funds, the bikeway master plan must address items (a) through (k) of Section 891.2 of the California Streets and Highways Code. For reviewer convenience, code text and associated document sections are listed below.

(a) The established number of existing bicycle commuters in the plan area and the estimated increase in the number of bicycle commuters resulting from implementation of the plan.

The established number of bicycle commuters in the plan area is 216. The estimated increase in the number of bicycle commuters resulting from implementation of this plan is five percent, or 226. The figures are substantiated in the following three paragraphs.

Imperial Beach has a population of approximately 26,992 (from SANDAG Census 2000 Profile, June 2003). According to the Census profile, approximately 73 percent of the population is employed, or 19,795 people for the City of Imperial Beach. SANDAG's Census Profile estimates that there are 11,721 people who commute to work and of that, 131 use the bicycle as a means of transportation. Results indicate that one percent of the commutes are done by bicycle.

To this number must be added children who ride bikes to school. According to Census Profile, the school age population (5-17 years old) is 21 percent of the overall population, or 5,684. According to surveys conducted at area schools for other similar studies over the last several years, roughly 1.5 percent of school age children ride bikes to school, or 85 in Imperial Beach.

These additional 85 school age bicycle commuters added to the 131 adult commuters yields an estimated City total of 216 bicycle commuters, or 1 percent of Imperial Beach's total population of 26,992. The estimated increase resulting from implementation of this plan is 10, or five percent more than the current 216 bicycle commuters in Imperial Beach, totaling 226. (Note that using SANDAG Census 2000 Profile data likely underestimates bike commuter numbers because the Census only asks for the primary transportation mode to work, missing the once or twice a week bike commuter. Also, more commuters are likely to bicycle in Southern California than the national average.)

(b) A map and description of existing and proposed land use and settlement patterns which shall include, but not be limited to, locations of residential neighborhoods, schools, shopping centers, public buildings and major employment centers.

Maps were derived primarily from data supplied by the U.S. Census Bureau via the San Diego Association of Governments (SANDAG). This information is contained in maps and text in Chapter 3, beginning on page 31, including Figure 3-1: Existing Land Use, Figure 3-2: Planned Land Use, Figure 3-3: Activity Locations, Figure 5-1: 2000 Population Density, Figure 5-2: 2002 Population Density, Figure 5-3: 2000 Employment Density and Figure 5-4: 2020 Employment Density.

(c) A map and description of existing and proposed bikeways.

Maps and description can be found in Chapter 4, beginning on page 4-1, and in Figure 4-1: Existing and Proposed Bikeway Facilities.

(d) A map and description of existing and proposed end-of-trip bicycle parking facilities. These shall include, but not be limited to, parking at schools, shopping centers, public buildings and major employment centers.

Available information is contained in maps in Chapters 3 and 5, starting on page 3-1, and in Figure 3-3: Activity Locations. Chapter 5 contains information regarding employment densities beginning on page 5-1 and in Figure 5-3: 2000 Employment Density and Figure 5-4: 2020 Employment Density. Bicycle parking facilities are generally provided at all schools, shopping centers, public buildings and major employment centers shown on the maps.

(e) A map and description of existing and proposed bicycle transport and parking facilities for connections with and use of other transportation modes. These shall include, but not be limited to, parking facilities at transit stops, rail and transit terminals, ferry docks and landings, park and ride lots, and provisions for transporting bicyclists and bicycles on transit or rail vehicles of ferry vessels.

This information is contained in Chapter 2, and Figure 2-2: Bus Routes and Bus Stops, on page 2-5. The City of Imperial Beach only has access to a bus route transit system within the City limits. Two trolley stations just east of the City in the City of San Diego are the closest rail transit stations. No major transit center resides in Imperial Beach.

(f) A map and description of existing and proposed facilities for changing and storing clothes and equipment. These shall include, but not be limited to, locker, restroom and shower facilities near bicycle parking facilities.

This map and description can be found in Chapter 3, beginning on page 3-1 and in Figure 3-3: Activity Centers. Chapter 5 discusses employment densities and in Figures 5-3: 2000 Employment Density and Figure 5-4: 2020 Employment Density. According to the City, some major employment centers and most large government facilities have locker, restroom and shower facilities.

(g) A description of bicycle safety and education programs conducted in the area included in the plan, efforts by the law enforcement agency having primary traffic law enforcement responsibility in the area to enforce provisions of the Vehicle Code pertaining to bicycle operation, and the resulting effect on accidents involving bicyclists.

The Public Safety Department instituted a Pedestrian and Bicycle Safety Program in November of 2004. The program was funded through a grant from the California Office of Traffic Safety. The goal of the grant was to reduce the number of pedestrian and bicycle involved traffic accidents. This was accomplished through public education and outreach and increased law enforcement focusing on helmet use by bicyclist and other safety rules. The education and outreach included presentations at local schools, Boys and Girls Club, Senior Citizen Groups, and other community groups. The placing of bicycle and pedestrian safety posters throughout the city in Spanish and English, and through the use of bicycle rodeos allowed law enforcement and other safety officials to give hands-on training to children. Free helmets were also provided to the kids. According to OTS traffic statistics, the city did realize a reduction of motor vehicle-bicycle collisions and injuries after the program was completed. The bicycle rodeos have continued at least once per year.

(h) A description of the extent of citizen and community involvement in development of the plan including, but not be limited to, letters of support.

Community involvement consisted of a public workshop conducted on March 29, 2007 at the City of Imperial Beach City Hall in which 22 people attended. This was the public meeting to introduce the Bicycle Transportation Plan (BTP) and Eco-Route Bikeway Palm Avenue Traffic Calming Project to the community. The first hour was dedicated to talking about the BTP while the second hour presented the design concept of the Eco-Route Bikeway Palm Avenue Traffic Calming Project. Some issues raised by the public was restroom facilities on the Bayshore Bikeway, the SR-75/Palm Avenue intersections and extending Class 1 bike paths to the coast.

(i) A description of how the bicycle transportation plan has been coordinated and is consistent with the local or regional transportation, air quality or energy conservation plans, including, but not be limited to, programs that provide incentives for bicycle commuting.

The selection of new bikeways proposed in this plan reflects review of regional transportation plans by providing linkages to regional bikeways wherever possible. The City of Imperial Beach has yet to implement some of the programmed bikeway facilities in the 1994 General Plan and Coastal Plan. Segments recommended in this update are intended to fill gaps in the existing system and look at alternatives to programmed and suggested facilities. The remainder is intended to provide school age children with safer routes to elementary and middle schools. This plan also works to make bicycle travel within the City of Imperial Beach more convenient and safe so that people are encouraged to reduce their motor vehicle travel in lieu of bicycles by providing more direct and consistent routes.

Local air quality, beach and coastline, climate, historical resources and open space conservation goals as expressed in the City of Imperial Beach General Plan and Coastal Plan include coordinating and guiding decisions related to the land and water areas which influence and shape the quality of the City. The Open Space and Conservation Element takes into consideration those open space areas necessary for the preservation and conservation of various natural resources, for outdoor recreation, for the enjoyment of scenic beauty and areas of historic/cultural value, and for the protection of public health and safety.

(j) A description of the projects proposed in the plan and a listing of their priorities of implementation.

The projects are can be found in Chapter 7, pages 7-1 to 7-18, in Table 8-2: Capital Improvement Projects.

(k) A description of past expenditures for bicycle facilities and future financial needs for projects that improve safety and convenience for bicycle commuters in the plan area.

In 1996, the City of Imperial Beach constructed their section of the Bayshore Bikeway for a cost of approximately $340,000. They also designed the Bayshore Bikeway Spur, a section from north of Salt Pond 30 in Coronado along SR-75 to Rainbow Drive. The design cost was approximately $250,000. The project however was rejected when the only qualified bid came in at over $2,000,000. This project is still in the five year CIP plan but there has been no active work on the project since the bid rejection in 2004. Past preliminary and feasibility studies have cost approximately $100,000.


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Executive Summary

Project Scope

This study is a comprehensive update of the 1994 City of Imperial Beach General Plan and Coastal Plan's Circulation Element. The city's growth necessitated an update to better address not only local bicycle travel needs, but also to better serve regional long-distance travel and promote ecotourism. This resulting document should be responsive to any General Plan changes that will affect circulation patterns.

Plan objectives included establishing facility types to be implemented and identifying points where the city's bikeway system could integrate with the existing San Diego metropolitan regional bikeway system. The project's scope included documenting and evaluating Imperial Beach's existing bikeway facility system and its relationship with other systems such as mass transit, and recommending improvements wherever appropriate.

This plan sought to maximize the efficiencies offered by multi-modal connections between mass transit and bikeways and to promote a viable alternative to the automobile travel in a climate particularly conducive to bicycle transportation. It also sought to provide a more convenient bikeway system for cyclists who do not have ready access to motor vehicles.

The Cyclist's Perspective

This plan was developed with a "cyclist's perspective" by planners who routinely commute by bicycle and fully understand the implications of bicycle travel. All potential routes were ridden to experience them firsthand, including those routes planners felt would be forbidding to most users due to high motor vehicle speeds and volumes. The planners' "on the ground" familiarity of the City and subsequent thorough analysis resulted in supportable recommendations portrayed in clear text and graphic format.

This plan incorporated the latest in geographic information systems (GIS) technology to support its mapping and planning recommendations. GIS data were used to characterize facility siting factors such as housing, population and employment densities.

Compliance with State Law

Pursuant to California law, this plan is to complement the City of Imperial Beach's General Plan Circulation Element was used to direct roadway improvements to include bikeway facilities.

By law, cities must adopt their bikeway master plans (termed "Bicycle Transportation Plans" by Caltrans) no earlier than four years prior to July 1 of the fiscal year in which the state's Bicycle Transportation Account (BTA) funds are to be granted. For example, the 2008/2009 fiscal year began on July 1, 2008. Cities applying for 2005/2006 BTA funds must have a bikeway master plan adopted July 1, 2004 or later. This four year cycle should help to make certain that General Plan changes affecting bicycle transportation will be accommodated in a timely manner.

Methodology

The project methodology included a review of applicable documents, field work and geographic information systems (GIS) analysis of the field work data. Imperial Beach's existing bikeway system was analyzed for a number of factors using both traditional field survey and GIS techniques.

Literature Review

Applicable sections of documents related to Imperial Beach's bikeway system are excerpted in Chapter 4: Bikeway Facilities. These include the current General Plan Circulation Element, as well as neighboring community, regional and state plans and guidelines.

Field Work

During the initial field work, all mapped routes were driven to verify accuracy with respect to existing bikeway mapping data. The consultant also rode many of these routes, especially those that did not appear to be consistent with the data. These discrepancies were often discontinuous routes or route extensions that had not been previously digitized.

Community Input

Community involvement consisted of a public workshop conducted on March 29, 2007 at the City of Imperial Beach City Hall in which 22 people attended. This was the public meeting to introduce the Bicycle Transportation Plan (BTP) and Eco-Route Bikeway Palm Avenue Traffic Calming Project to the community. The first hour was dedicated to talking about the BTP while the second hour presented the design concept of the Eco-Route Bikeway Palm Avenue Traffic Calming Project. Some issues raised by the public was restroom facilities on the Bayshore Bikeway, the SR-75/Palm Avenue intersections and extending Class 1 bike paths to the coast.

Project Approach

The overall approach taken in this master plan can be summarized as the following:

- The bicycle master plan should be integrated into all transportation plans, especially if the bicycle will use general purpose roads shared with other forms of transportation.
- An administrative framework and the support of public interest groups is critical for the success of a master plan effort.
- The aim of planning for bicycles should not be focused on any particular product so much as it should be focused on the safe and efficient travel of cyclists. This will generally require both the use of the existing transportation infrastructure and the construction of special facilities for cyclists.
- The maintenance of bicycle facilities and the monitoring and assessment of their performance must ensure continuing safe and efficient travel for cyclists. Planning for cyclists is an on-going process.
- The coexistence of cyclists and drivers on the roads requires that both are sensitive to and recognize a common set of rules. Training, education and enforcement are as important as physical planning and design.
- It is imperative that a “bicycle perspective” guide any planning for cyclists. The bicycle has its own characteristics, constraints and opportunities that the planner must consider. This must be combined with the recognition that cyclists do not form a homogeneous group in terms of age, ability, experience or traffic judgment.

Funding Sources

Appropriate funding for bikeway facilities could come from many sources. An increased emphasis on integrated multi-modal planning has created several federal, state and local funding sources for new bicycle facilities. Understanding the grant program and selection criteria of these programs can dramatically increase the likelihood of funding. The applicable funding sources will be somewhat dependent on the selected conceptual framework for the bikeway system. (See Chapter 7: CIPs and Bikeway Funding.)

Proposed bikeway facilities reflect an understanding of budgetary constraints. The planning team’s approach was to emphasize solutions for which funding is most readily available, but not to the exclusion of the goals and objectives of the master plan.

Bikeway Continuity

Many existing systems receive less use than projected because the potential users view them as too piecemeal in configuration, and therefore inefficient and unsafe. The creation of an effective bikeway system may be achieved with steps as relatively simple and cheap as re-striping roadways and installing signage, but it will probably also require more costly measures such as the establishment of easements, removal of encroachments, or even the outright purchase of land. The planning team's approach included evaluation of methods for maintaining bikeway cohesiveness, with proposed solutions within the proper conceptual framework.

Understanding Cyclists' Needs

Only a cyclist truly understands the needs of a cyclist. The proper cycling perspective must permeate the bikeway planning process. This issue is fully understood by the planning team members. It has much to do with the team's desire to pursue this planning project; to see it done right. The team's personnel selection was based in part on cycling experience.

Project Goals

The following project goals were developed in close cooperation with City staff. These goals are the fundamental criteria for the City of Imperial Beach's planned bikeway system.

1. Popular
Bikeway system design and layout will consider all segments of the cycling population.

2. Systemic
The bikeway system will endeavor to be a complete system emphasizing local and regional continuity and connectivity.

3. Destination-Oriented
The bikeway system will be destination-oriented, especially towards employment centers, residential areas and high use activity centers – including access to other modes of local and regional transportation systems.

4. Safe
Safety will be the bikeway system's paramount concern, focusing on maximum visibility for the cyclist, signage, bikeway segment selection and utilizing easily recognized markers to clearly identify paths, lanes and routes.

5. Designed to Standards
The bikeway system will conform to the minimum design standards established by Caltrans. Facilities will endeavor to include, but not be limited to, bike lockers and locking racks.

6. Maintained
The City will regularly maintain bikeway system segments and facilities.

7. Minimize Liability Exposure
Bikeway system design and layout will minimize the City's and adjacent property owners' liability exposure to issues such as trespassing, loss of privacy, damage and property loss associated with bike routes.

8. Minimize Cost
Whenever possible, bikeway system design and layout will minimize potential financial burden to the City by engaging development to implement bike segments, locating segments within the existing right-of-way and minimizing the need for acquisition.

9. Environmentally Sensitive
Whenever possible, the bikeway system will utilize environmentally sensitive routing to minimize environmental impacts.

10. Educational
The bikeway master plan will consider methods not only to promote the benefits of cycling, but also to enhance safety by educating both cyclists and drivers to coexist with an awareness of each other.

Project Definitions

To prevent the confusion that can occur when referring to bikeways, bicycle lanes, bicycle routes, bicycle trails or bicycle paths, the California Department of Transportation (Caltrans) standards for referring to bikeway facility types are used throughout this document. (See photos and Section 1.3: Bikeway Facility Types on pages 1-1 and 1-2.)

Trip Origin and Destination Analysis

Analysis of specific types of bicycle trip origin and destination points are required by Caltrans for its approval of bikeway master plans. The standard Caltrans list includes residential neighborhoods, schools, shopping centers, public buildings and major employment centers (Bicycle Transportation Account Compliance - Code Section 891.2). These were identified and analyzed and further supplemented by additional types of origin and destination points. Other trip origin and destination points included the city hall, hospitals, park and ride lots, train stations, transportation centers, parks, community or visitors center and libraries. (See Chapter 3: Land Use Analysis.)

Multi-Modal Analysis

Linking the bikeway facility system with other transportation modes can enhance the efficiency of bicycle transportation, especially for commuting cyclists. They can use their bicycles to get to or from a multi-modal transfer point as part of their regular commute. Where transit modes allow bicycles on board, multi-modal transit becomes a very useful transportation option. Whether the other modes allow bicycles to be brought on board or not, they allow for much greater flexibility for persons choosing to commute by modes other than the private automobile. (See Chapter 2: Circulation Element.)

Safety Analysis

Safety is a primary concern in evaluating an existing bikeway facility system or in proposing new facilities or extensions. The primary lesson learned from the literature reviewed for this bicycle master plan and others is that installation of bicycle facilities without careful consideration of their specific attributes and drawbacks can actually exacerbate already problematic safety situations. This is particularly true for facilities that are likely to be used by other types of users such as walkers, runners and skaters, in addition to cyclists. Well designed, attractive, off-street bicycle facilities tend to become mixed use facilities and the other user types do not move with the relative predictability of vehicles. On the other hand, even though they move with more predictability, cyclists using on-street facilities must contend with motor vehicles. Safety concerns vary considerably depending on the type of bicycle facility. (See Chapter 4, Section 4-4: Bicycle Collisions.)

Opportunities and Constraints

Most of the bikeways proposed in this bikeway transportation plan update have been proposed in other documents, such as in the existing 1994 General Plan and Coastal Plan as well as the Bicycle Route Feasibility and Traffic Calming Study (2005). Whenever possible, routes were proposed to take advantage of opportunities to make connections between bicycle trip origin points and destination points in sections of the city that may not otherwise be accessible via a bikeway facility. This was generally feasible due to overall manageable grades within the city. The opportunities for a viable bikeway system in the City of Imperial Beach are in place. (See Chapter 7: Analysis and Recommendations.)

Current Constraints to Cycling

Lack of Amenities along the Bayshore Bikeway

The Bayshore Bikeway is a popular route in southern San Diego which connects the City of Coronado to Imperial Beach. This north-south route has over eight miles of bike path, interpretive stations and beach access. It does however lack amenities such as restrooms and bicycle parking, particularly along Imperial Beach. This plan identifies missing amenities and makes recommendations.

High Motor Vehicle Speeds

Imperial Beach only has two city blocks worth of existing Class 2 bikeway facilities and is on an arterial roadway with relatively high posted motor vehicle speeds. Experienced cyclists are generally not concerned with adjacent motor vehicle speeds when on a Class 2 bike lane, but when facilities do not exist it becomes more of a concern. Less experienced cyclists are more likely to find such conditions very uncomfortable and may be less likely to use these high speed roadways.

Narrow Roadways

Many roadways in Imperial Beach on which Class 2 bicycle facilities are proposed have adequate rights-of-way. However, implementation of some proposed routes may be constrained by the lack of available physical space because the some roadways on which they are proposed may have limited rights-of-way and on-street parking. Providing bicycle facilities such as Class 3 bike routes are the best solutions for connectivity in a City already built out. Imperial Beach is predominantly residential land use so speeds are relatively low with some streets wide enough to accommodate cyclists without the use of bike lanes.

Recommendations

The recommended routes are intended to take advantage of existing and programmed roadways and existing bicycle facilities to resolve cyclists' concerns for safety and connectivity. The City of Imperial Beach lacks a comprehensive system of Class 2 bikeways on its major roadways, with no existing Class 3 routes. The Class 1 Bayshore Bikeway is the only major bicycle facility near the City. The facilities shown in Figures 8-1: Bikeway Facilities on page 8-5 represent all three types of proposed bikeways and are delineated by proposed CIP segment numbers.

CIPs and Bikeway Funding

The following sections define the recommended bikeway system improvements as CIP projects with basic construction costs. See table 8-1: Typical Unit Construction Costs for general bikeway component construction costs. For a brief description of each segment, including estimated costs and segment lengths, see Table 8-2: Capital Improvement Projects. The remaining sections of Chapter 8 describe the funding sources available for bikeway projects, followed by a summary, Table 8-3: Bikeway Facility Funding Summary.

Bikeway Development Priorities

The factors used in prioritizing the implementation of potential bikeway project types included probable demand, regional significance, transportation efficiency and likely funding sources. With these criteria, completion of the Eco-Route was given first priority, followed by routes that would most benefit bicycle transportation.

Note that the segment numbering sequence lists the Class 1 Bayshore Bikeway connections first, along with separate lists of proposed Class 2 facilities and the Class 3 facilities. This represents the recommended prioritization within facility classes only. It is difficult to prioritize all of the proposed bikeway facilities across the facility classes because several Class 3 routes could be implemented for far less than the cost of a single Class 2 lane, for example. Therefore, it is recommended that the Class 1, 2 and 3 facilities be regarded as parallel lists and be implemented as appropriate funds become available for each type of facility. (See Table 8-2: Capital Improvement Projects, for more information.)

Class 1 Bikeways Costs

Because they are constructed independently of existing or programmed motor vehicle facilities, Class 1 paths are by far the most expensive of all bicycle facilities. Typical costs per mile can vary a great deal due to possible right-of-way acquisition, bridges and other potential major expenses such as extensive grading. The cost range is primarily due to topography and facility width. For example, a Class 1 facility being converted from a rail roadbed across flat terrain will require far less grubbing, grading and structural enhancements than a facility being constructed through an undeveloped area with hilly topography. For this bikeway master plan, the cost used in Table 8-2 for the rail trail segment was $466 per linear foot, or approximately $2,460,480 per mile, due to potentially extensive construction, grading, bridges and environmental review. A more standardized figure was used for the other Class 1 segments of $190 per linear foot, or $1,000,000 per mile.

Class 2 Bikeways Costs

Class 2 facility costs are approximately $15,000 to $35,000 per mile. This cost includes all necessary lane striping and signage, but does not include widening of roadways or land acquisition, if necessary. The cost used in Table 8-2 was $6 per linear foot, or approximately $32,000 per mile.

Class 3 Bikeways Costs

Class 3 routes costs are the lowest of all facility types because the only physical improvement to be installed is route signage. The cost range is $1,500 to $5,000 per mile. The cost used in Table 8-2 was $0.70 per linear foot, or approximately $3,500 per mile.

Bikeway Funding Sources

Federal, State and local government agencies invest billions of dollars every year in the nation's transportation system. Only a fraction of that funding is used in development projects, policy development and planning to improve conditions for cyclists. Even though appropriate funds are limited, they are available, but desirable projects sometimes go unfunded because communities may be unaware of a fund's existence, or may apply for the wrong type of grants. Also, the competition between municipalities for the available bikeway funding is often fierce.

Whenever Federal funds are used for bicycle projects, a certain level of State and/or local matching funding is generally required. State funds are often available to local governments on similar terms. Almost every implemented bicycle program and facility in the United States has had more than one funding source and it often takes a good deal of coordination and opportunism to pull the various sources together.

According to the FHWA's publication, *An Analysis of Current Funding Mechanisms for Bicycle and Pedestrian Programs at the Federal, State and Local Levels*, where successful local bike facility programs exist, there is usually a full-time bicycle coordinator with extensive understanding of funding sources. Cities such as Seattle, Washington, Portland, Oregon and San Diego are prime examples. Bicycle coordinators are often in a position to develop a competitive project and detailed proposal that can be used to improve conditions for cyclists within their jurisdictions. Much of the information on Federal and State funding sources was derived from the previously mentioned FHWA publication.

Additional Resources

Chapter 9 contains a comprehensive set of bikeway design guidelines.

The appendices contain applicable state and federal bikeway planning publications, guidelines for selecting safe routes to school, and the California Vehicle Code sections on roadway bicycle use. The final appendix is the entire Caltrans H*ighway Design Manual Chapter 1000 – Bikeway Planning and Design*.

1 Introduction

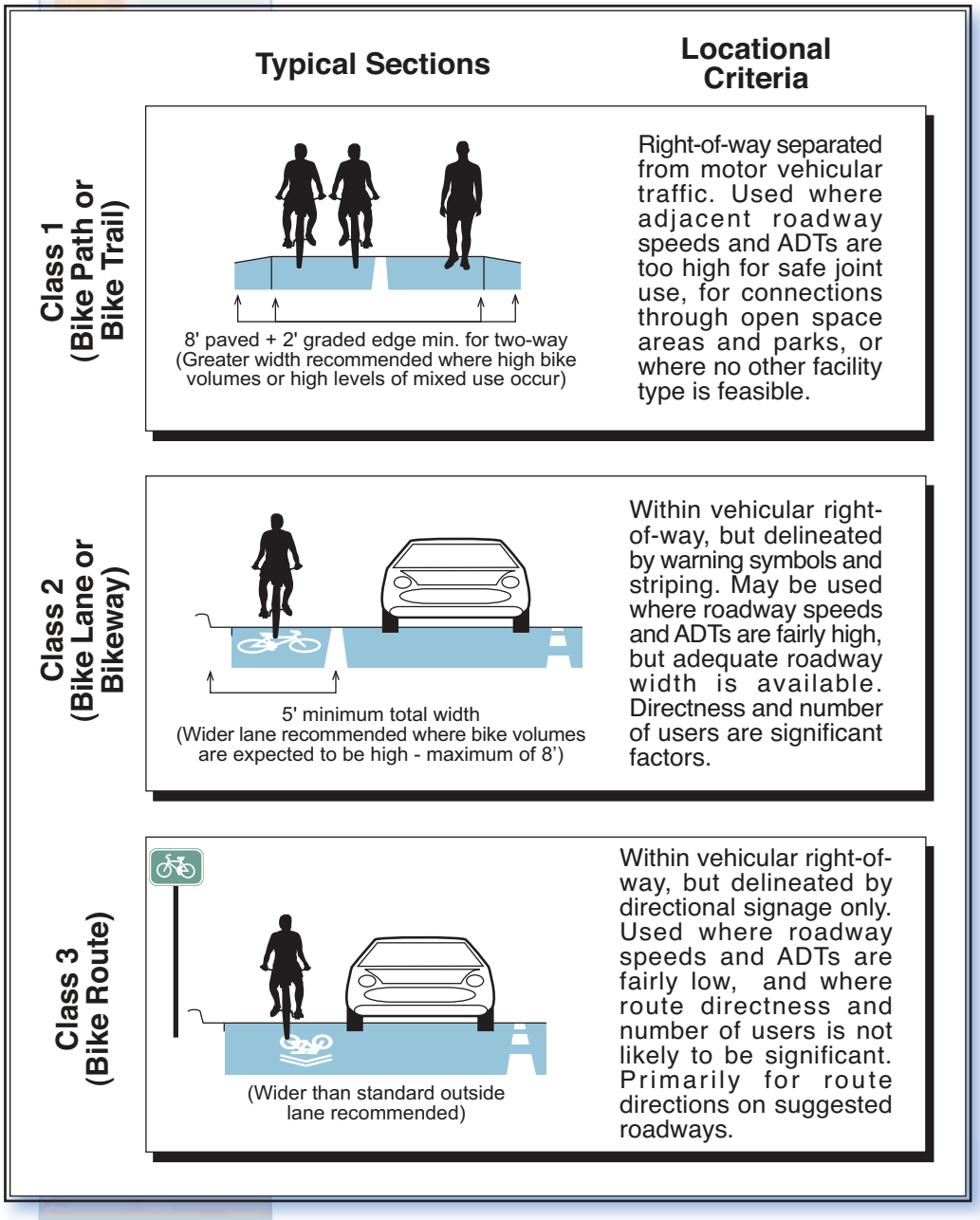
1.1 Project Scope

The scope of this report is to identify the existing conditions within the City of Imperial Beach, which will help the Bicycle Transportation Plan to determine the needs and feasibility of proposed projects from the 1994 City of Imperial Beach General Plan. Included in this report are current circulation element excerpts, existing and proposed land use, existing and proposed bicycle facilities, as well as collisions, bikeway facility types, activity locations, public transportation and the proposed Eco-Route Bikeway. This chapter also defines facility types.

1.2 Field Work

Field work was conducted in February, April and May of 2007 under mostly sunny skies and temperatures in the 60s.

Figure 1.1 Bikeway Facility Types



1.3 Bikeway Facility Types

Bikeway facilities considered for this study include Class 1 bike paths, Class 2 bike lanes and Class 3 bike routes. The following text and graphics describe their relative uses and attributes. (See figure at left.)

1.3.1 Class 1 Bike Paths

Class 1 bike paths are hard-surface routes within an exclusive right-of-way physically separated from vehicular roadways and intended specifically for non-motorized use. They are generally two-way with center striping, with a minimum paved width of eight feet, with an additional two feet of graded edge on each side, for a total of twelve feet. These facilities, although funded and designated as bikeway facilities, are frequently used by other non-motorized users and should be designed to account for them. Where volumes are anticipated to be high, and where significant numbers of other user types will be likely to use the path, additional width should be provided.

1.3.2 Class 2 Bike Lanes

Class 2 facilities are marked bicycle lanes within roadways adjacent to the curb lane, delineated by appropriate striping and signage. Bicycle lanes help to delineate available road space for preferential use by cyclists and motorists, and to promote more predictable movements by each. Bicycle lane markings can increase a cyclist's confidence in motorists not straying into his/her path of travel. Likewise, passing motorists are less likely to swerve to the left out of their lane to avoid cyclists on their right.

Bicycle lanes must be one-way facilities and carry traffic in the same direction as adjacent motor vehicle traffic. Two-way bicycle lanes on one side of the roadway are unacceptable because they promote riding against the flow of motor vehicle traffic. Wrong-way riding is the primary cause of bicycle crashes and violates the "Rules of the Road" stated in the Uniform Vehicle Code. Bicycle lanes on one-way streets should be on the right side of the street. In unique situations, it may be appropriate to provide a contra-flow bicycle lane on the left side of a one-way street where it will decrease the number of conflicts (e.g., those caused by heavy bus traffic). Where this occurs, the lane should be marked with a solid, double yellow line and the width of the lane should be increased by one foot.

Typical Class 2 Lane with adjacent parking (City of Encinitas)

Under ideal conditions, the minimum bicycle lane width is five feet, but certain edge conditions can dictate additional desirable bicycle lane width. However, even where roadway width is available, Class 2 bike lanes should be no wider than eight feet to prevent the appearance of a travel lane that could encourage motorists to drive in them.

If parking volume is substantial or turnover is high, an additional one or two feet of width is desirable for safe bicycle operation. Bicycle lanes should always be placed between the parking lane and the motor vehicle lanes. Bicycle lanes between the curb and the parking lane can create obstacles for cyclists and eliminate a cyclist's ability to avoid a car door as it is opened. Therefore, this placement should not be considered.

The Caltrans Highway Design Manual depicts four common locations for such facilities in relation to the roadway. (See figure on next page.) The first section depicts bicycle lanes on an urban curbed street where a striped parking lane is provided. The minimum bicycle lane width for this location is five feet.

The second section depicts an urban curbed street where parking is allowed, but without striping for a separate bike lane. This parking lane shared with bicycles should be 11 to 12 feet wide (3.3-3.6 meters). 13 feet (4m) is recommended where parking turnover is high, such as commercial districts. Cyclists do not generally ride near a curb because of the possibility of debris, of hitting a pedal on the curb, of an uneven longitudinal joint, or of a steeper cross slope.

The third section shows a roadway where parking is prohibited. Bicycle lanes in this location should have a minimum width of five feet (1.5m) where a curb occurs (measured from the curb face) and four feet (1.2m) where no curb is used. If the longitudinal joint between the gutter pan and the roadway surface is uneven and falls within five feet of the curb face, a minimum of four feet should be provided between the joint and the motor vehicle lanes.

The fourth section depicts lanes on a roadway without curbs where parking is prohibited.

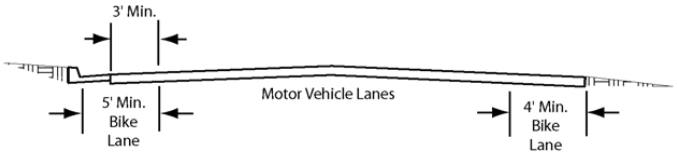
Figure 1.2 Typical Class 2 Bike Lane Sections

Figure 1003.2A
Typical Bike Lane Cross Sections
(On 2-lane or Multilane Highways)

(1) MARKED PARKING

* 13' is recommended where there is substantial parking or turnover of parked cars is high (e.g. commerical areas).

(2) PARKING PERMITTED WITHOUT MARKED PARKING OR STALL



(With Gutter) **(3) PARKING PROHIBITED** (Without Gutter)

(4) TYPICAL ROADWAY IN OUTLYING AREAS PARKING RESTRICTED

Note: For pavement marking guidance, see the MUTCD and California Supplement, Section 9C.04

Source: CALTRANS Highway Design Manual - Chapter 1000

1.3.3 Class 3 Bike Routes

A Class 3 facility is a suggested bicycle route marked by a series of signs designating a preferred route between destinations such as residential and shopping areas. A network of such routes can provide access to a number of destinations throughout the community. In some cases, looped systems of scenic routes have been created to provide users with a series of recreational experiences. In addition, such routes can provide relatively safe connections for commuting to workplaces or schools.

The designation of a roadway as a Class 3 facility should be based primarily on the advisability of encouraging bicycle use on that particular roadway. While the roadways chosen for bicycle routes may not be free of problems, they should offer the best balance of safety and convenience of the available alternatives.

In general, the most important considerations are pavement width and geometrics, traffic conditions and appropriateness of the intended purpose. A certain amount of risk and liability exists for any area that is signed as a Class 3 bike route. The message to the user public is that the facility is a safe route. Therefore, routes should not be placed on streets that do not meet appropriate safety standards.

How appropriate a particular roadway is for a bicycle route include directness, connectivity with other bicycle facilities, scenery and available services. Directness is important for cyclists traveling for a purpose, such as commuting, though this is not the case for recreational riders, for whom scenery or fitness may be the primary factor in selecting a route. For recreational riders traveling more than a few miles, services such as food, water, restrooms and pressurized air may be of interest.

According to the *Manual of Uniform Traffic Control Devices* (MUTCD), Bicycle Route Guide (MUTCD Sign Type D11-1) signs should be provided at decision points along designated bicycle routes, including signs to inform bicyclists of bicycle route direction changes and confirmation signs for route direction, distance, and destination. These signs should be repeated at regular intervals so that bicyclists entering from side streets will know that they are on a bicycle route. Similar guide signing should be used for shared roadways with intermediate signs placed for bicyclist guidance. (See below.)

MUTCD Sign Types W11-1 and W16-1 (Share the Road with Bicyclists Assembly)

Typical Class 3 Route (City of Encinitas)

MUTCD Sign Type D11-1 (Class 3 Route Sign) and "Sharrow" Shared Lane Marking

2 Circulation Element

2.1 Roadway Classifications

Like most cities in the San Diego region, the City of Imperial Beach's predominant street classification is the residential street. The City has roughly 38 miles of residential street, which are primarily two-lane roads. These residential streets and alleys create a grid system with few access limitations from collector streets to primary and major arterials.

According to SanGIS data, collector streets that connect multiple street networks can be found on Seacoast Drive from Imperial Beach to Palm Avenue, 3rd Street from Imperial Beach Boulevard to Palm Avenue, Connecticut Street from Iris Avenue to Elm Avenue, 9th Street from Fern to Palm Ave, 13th Street from Iris to Palm Avenue as well as Palm Avenue from 8th Street to Seacoast Drive. Other smaller collector street include 3rd Avenue from Palm Avenue to the northern City limit, Rainbow Drive from SR-75 to Palm Ave, Grove Avenue from 13th Street to the 15th Street and Iris Avenue from 13th Street to 15th Street.

2.1.1 Palm Avenue/SR-75

The prime arterial is Palm Avenue from where it merges with SR-75 eastbound to 13th Street, at the City limit. This is also the northern most east-west connection to Interstate 5. This prime arterial is a six-lane road from 13th Street and shrinks down to a four-lane collector street between the SR-75 merge and Third Avenue. Parallel parking can be found along the six-lane stretch of Palm Avenue. According to SANDAG data, the Average Daily Trips (ADT) along the six-lane stretch of Palm Avenue can exceed 37,000 ADT. Between SR-75 and Seacoast Drive, the traffic volume is 14,615 ADT. Reduction in trips is partly the result of the merge northbound onto SR-75, which becomes the Silver Strand into the City of Coronado. The section of SR-75 within the City limits has traffic volumes of between 18,000 to 21,000 ADT.

West on Palm Avenue

2.1.2 Imperial Beach Boulevard

Imperial Beach Boulevard is a major four-lane arterial from Seacoast Drive eastbound to the city limit street where it becomes Coronado Avenue in the City of San Diego. This serves as the southernmost east-west connection between Interstate 5 and the coast. The most heavily used section of Imperial Beach Boulevard is from 9th Avenue eastward to the City limit with traffic volumes ranging from 14,000 to 19,000 ADT. There are multi-family and commercial areas along this stretch of Imperial Beach Boulevard. Another reason for traffic volumes is the connection from the City of San Diego that allows drivers to access SR-75 via 9th Street, as well as two elementary schools within one block north and south of Imperial Beach Boulevard. From 9th Avenue to Seacoast Drive, traffic volume is 8,092 ADT.

2.1.3 Seacoast Drive

Seacoast Drive provides north-south circulation at the western boundary of the City and access to the beach area. This two-lane collector street has traffic volumes of 5,000 ADT between Palm Avenue and Elm Avenue, which is adjacent to shops and restaurants. From Elm Avenue to Imperial Beach Boulevard, traffic volumes are lower, to about 4,233 ADT, and then down to 2,228 ADT from Imperial Beach Boulevard to the southern end of Seacoast Drive, where it is primarily single and multi-family residential. Beach access does play a role in seasonal ADT ranges along Seacoast Drive. According to the General Plan, an increase of 5,000-6,000 ADT occurs along Seacoast Drive from Palm Avenue to Imperial Beach Boulevard during the summer months. On-street parking occurs throughout Seacoast Drive.

Seacoast Drive at Dunes Park

2.1.4 Thirteenth Street

Thirteenth Street is the entrance to Imperial Beach Naval Outlying Field (NOLF) to the south and travels to the northern City limits and the Bayshore Bikeway. This four-lane collector accommodates bus stops and traffic volumes between 10,000 to 12,500 ADT from Palm Avenue to Iris Avenue. The quarter-mile section from Palm Avenue north to the Bayshore Bikeway has a traffic volume of 5,190 ADT and is surrounded by open space preserve, residential land use and warehouses. On-street parking occurs all along 13th Street.

2.1.5 Ninth Street

Ninth Street extends north from Iris Avenue and the Imperial Beach NOLF to a cul-de-sac just north of Cypress Avenue. This four-lane collector street has a traffic volume of 3,855 ADT from Imperial Beach to Sea Park Drive just north of Imperial Beach NOLF and a volume of 6,678 ADT from Imperial Beach Boulevard north to Palm Avenue. On-street parking, both parallel and diagonal, can be found throughout Ninth Street. North of Calla Avenue, 9th Street becomes a two-lane residential street.

2.1.6 Connecticut Street/Encina Avenue/7th Street

This two-lane north-south route connects Iris Avenue from NOLF Imperial Beach to the northern City limits and the Bayshore Bikeway. The Eco-Route uses this segment as its easternmost route and one of its north-south connections.

Connecticut Street south from Elm Avenue

2.1.7 Iris Avenue

Iris Avenue is a two-lane residential street and is the southernmost east-west connection that connects 5th Street to Connecticut Street and 10th Street to the eastern City limit where it becomes Satellite Street in the City of San Diego. From 13th Street to the City limit, Iris Avenue becomes a two-lane collector street with on-street parking on the westbound side only.

2.1.8 Rainbow Drive

This 830-foot segment connects SR-75 and Palm Avenue. It functions as a two-lane collector street with a traffic volume of 4,986 ADT.

2.2 Public Transportation

2.2.1 Bus Transit

The Metropolitan Transit System (MTS) provides bus transportation within the City of Imperial Beach. The three bus routes serving the City are located along Palm Avenue, Rainbow Drive, Seacoast Drive, Imperial Beach Boulevard, 9th Street, Holly Avenue and 11th and 13th Streets south of Imperial Beach Boulevard. According to SANDAG's 2001 Transit Stop data, the highest account of boardings and alightings within the City of Imperial Beach is the bus stop on Palm Avenue and 9th Street serving westbound commuters on Route 933 with a daily average of 435 people. The second most utilized bus stop is across the street at the Palm Avenue and 9th Street bus top serving eastbound commuters on Route 934 at an average of 281 people per day. There are two other bus stops with over 200 users a day. The Imperial Beach Boulevard and 13th Street eastbound bus stop accommodates Route 933 and averages 219 users while the Imperial Beach Boulevard and California Street westbound stop sees an average of 201 users per day on Route 934. Bus service within the City experiences relatively high ridership levels due to the ease of access and connectivity provided by the grid street pattern.

2.2.2 Trolley Access

There is no trolley station within the City limits. The closest trolley stations to the City of Imperial Beach are on Palm Avenue and Iris Avenue just east of the City limits in the City of San Diego. These stations are along the Blue Line and can connect passengers south to the San Ysidro border crossing and north to downtown San Diego.

Figure 2.1 Street Classification

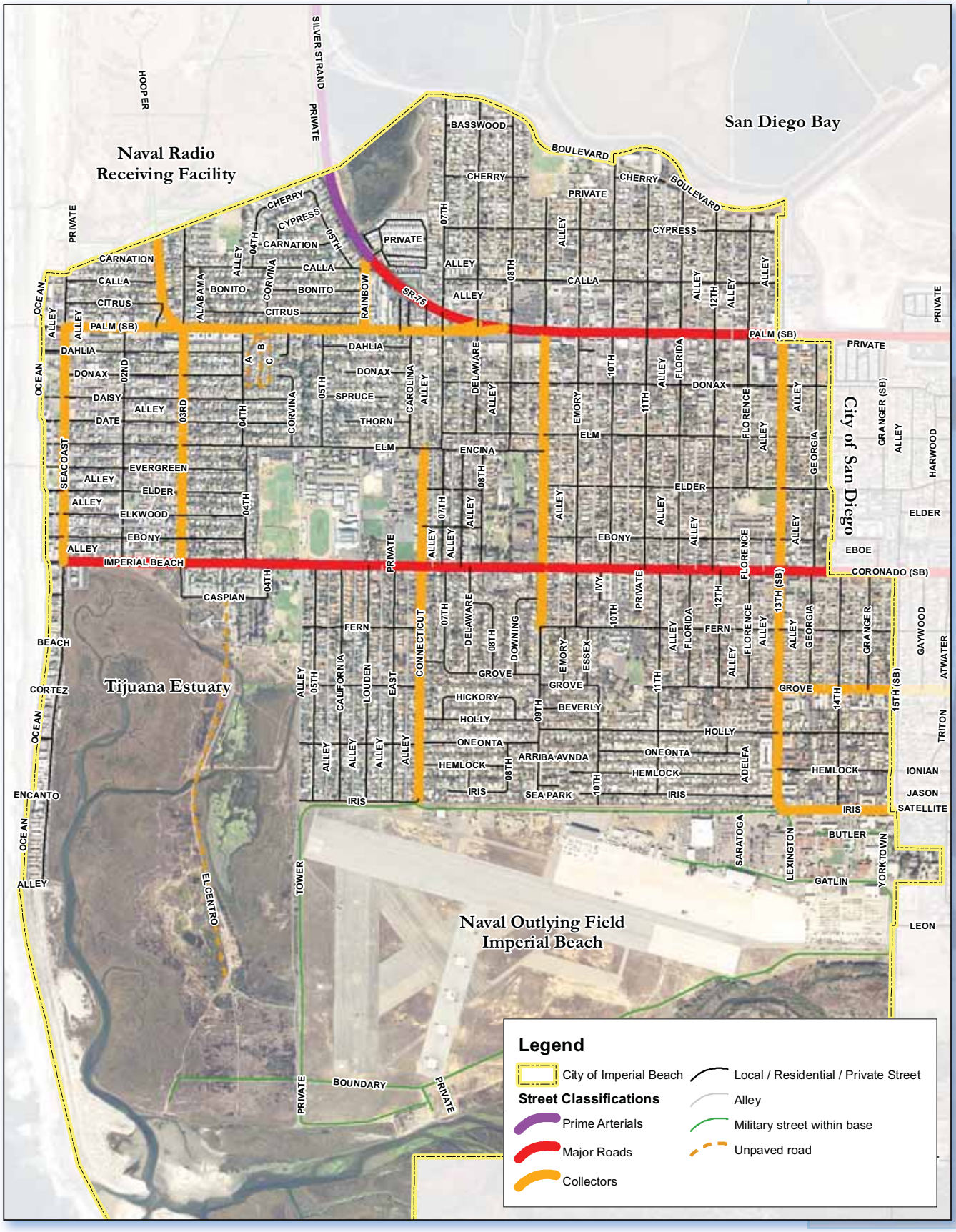


Figure 2.2 Bus Routes and Bus Stops

Figure 2.3 Bus Stop Boardings and Alightings

3 Land Use Analysis

3.1 Existing Land Use

The largest land use category within the City of Imperial Beach is open space, which encompasses the southwesternmost part of the City. This open space is the Tijuana Estuary and the Border Field State Park. Open space encompasses 36% of the land while single-family residential is second with 19% of the City land use. The military, which operates the Naval Outlying Field, takes up 6% of city as does multi-family residential. Multi-family residential can be found throughout the City but the largest concentrations are near the larger commercial strips and along major and collector arterials. Nonconforming industrial land use can be found in the northern edge of the city along the Bayshore Bikeway. Commercial uses can be found along Palm Avenue, Seacoast Drive and the corner of 13th Street and Imperial Beach Boulevard.

3.2 Planned Land Use

SANDAG future land use calls for more multi-family residential on the eastern side of the City between Palm Avenue and Iris Avenue and west of 9th Street. Currently this part of the City is a mix of single-family and multi-family residential. A two percent increase in multi-family and two percent decrease in single-family residential is planned. More multi-family residential is planned between Seacoast Drive and 3rd Street on the City's western limits and north of Calla Avenue between 7th Street and 13th Street. Commercial land use will increase along Seacoast Drive and Palm Avenue and stay relatively the same around the corner of 13th and Imperial Beach Boulevard.

3.3 Activity Locations

3.3.1 Schools

There are five elementary schools in the City of Imperial Beach; Westview, Bayside, Imperial Beach, Central and Oneonta. The schools are spread across the city and are primarily accessed from adjacent residential streets, with the exception of Imperial Beach Elementary, which is along Imperial Beach Boulevard. Mar Vista High School is the only high school in the City and enrolls over 2,200 students

Imperial Beach Pier

3.3.2 Parks and Recreation

Six local parks can be found in the City with two on the oceanfront; Dunes Park and Pier Plaza on Seacoast Drive. The two largest parks are The Sports Park on Imperial Beach Boulevard and Veterans Park on 8th Street. The easternmost park is the Rose Teeple Memorial Park on the corner of Florida Street and Calla Avenue.

Pier Plaza is the gateway to the Imperial Beach Pier and boasts a 15,000 square foot safety center building, which includes a safety center, amphitheater, and retail spaces, on a 2.5-acre waterfront open space. Also included are a pier boardwalk, seawall and an extension of the existing park. Dunes Park is a popular park which displays

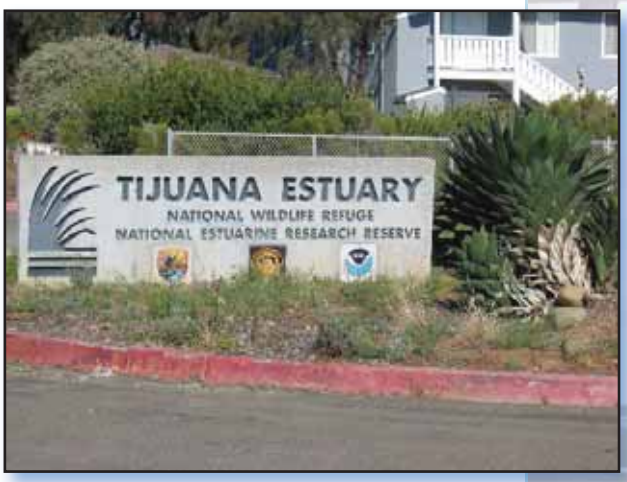
sculptures and has amenities such volleyball courts, a playground and picnic areas. The Sports Park has one small gym, with one game room, teen room, music room with recording studio and outside patio. There are six multipurpose fields for baseball or softball and an outside basketball court with a playground and picnic area. Rose Teeple Park on the corner of Calla Avenue and Florida Street includes multiple playgrounds and picnic areas and primarily serves as a neighborhood park for the local residents. Veterans Park on 8th Street has a stage, picnic trellis and playgrounds. To the south of the park is the Imperial Beach Library and to the north, the Girls and Boys Club. Reama Park is a neighborhood park located on 2nd Street in between Elder Ave and Elkwood Ave. It provides multiple playgrounds and areas of open grass.

3.3.3 Commercial

The largest span of commercial land use is along Palm Ave between 13th Street and Rainbow Drive. Palm Avenue from Third Street to Seacoast Drive and southbound on Seacoast Drive to Imperial Beach Boulevard is the second largest span of commercial land use. This section of commercial properties serves the beachgoers and is primarily small shops and restaurants and some single and multi-family residential in between. The corner of 13th Street and Imperial Beach Boulevard is the third largest pocket of commercial land use

3.3.4 Naval Outlying Airfield (NOLF) Imperial Beach

The Naval Outlying Field (NOLF) is part of the North Island Naval Air Station and hosts most of the Pacific Fleet's helicopter training. NOLF Imperial Beach consists of approximately 1,100 acres and is the only exclusive-use Naval helicopter airfield on the west coast. The principle function of NOLF Imperial Beach is to provide landing practice training for Pacific Fleet aviation personnel. Navy helicopters based at Naval Air Station (NAS) North Island routinely fly to NOLF Imperial Beach to conduct training and practice operations. The Navy trains over 40 percent of the helicopter pilots in the entire Navy at NOLF Imperial Beach. Instrument Flight Training at NOLF Imperial Beach is mandatory to qualify these pilots for Naval aviation duty.



3.3.5 Tijuana Estuary

The Tijuana Estuary encompasses the southwestern portion of the City of Imperial Beach and is located in a highly urbanized environment. This preserve is along the international border of the United States and Mexico. The Tijuana Estuary is at the lower end of the Tijuana River watershed of which three quarters of the watershed is within Mexico. The reserve encompasses beach, dune, mudflat, saltmarsh, riparian, coastal sage and upland habitats surrounded by the growing cities of Tijuana, Imperial Beach and San Diego. The Tijuana River Estuary is one of the few salt marshes remaining in Southern California, where over 90% of wetland habitat has been lost to development. The site is an essential breeding, feeding and nesting ground and key stopover point on the Pacific Flyway for over 370 species of migratory and native birds. The reserve is home to seven threatened and endangered species, including the Light-footed clapper rail, California least tern, Least Bell's vireo, salt marsh bird's beak, cordgrass,

Tijuana Estuary

white pelicans and numerous shorebirds. The reserve environment is a saline marsh habitat for most of the year with the Tijuana River being an intermittent stream system subject to changes in stream flow at different times of the year.

Access to the estuary's trail system can be found on Seacoast Drive, the Tijuana Estuary Visitor's Center on Caspian Way, the corner of 5th and Grove and the corner of Iris Avenue and 5th Street. The Reserve offers four miles of trails, taking visitors into prime bird watching areas and down to the river mouth where the Tijuana River meets the Pacific Ocean. Visitors may explore the park on their own or join one of the free guided nature and bird walks on weekends.

Figure 3.1 Existing Land Use

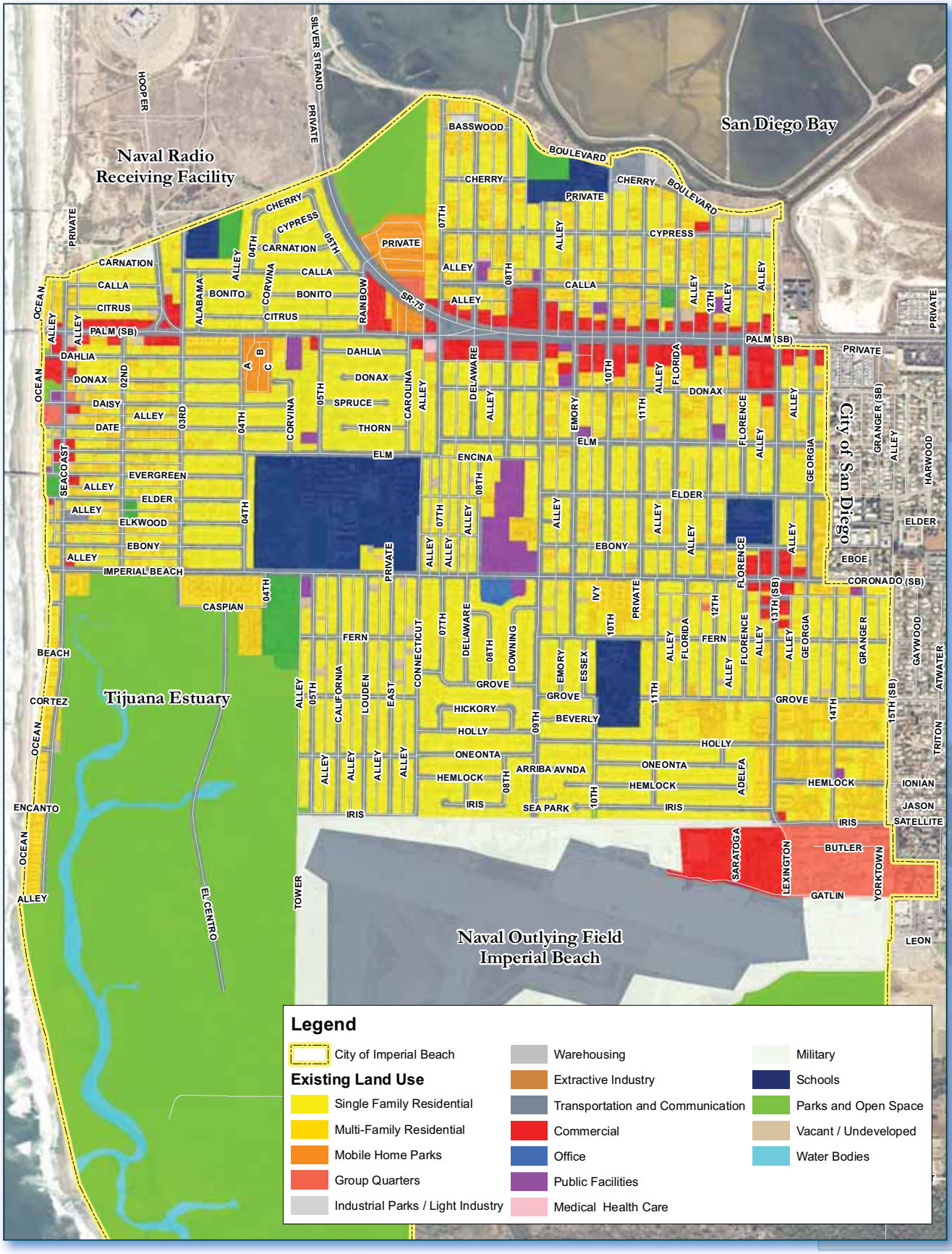


Figure 3.2 Planned Land Use

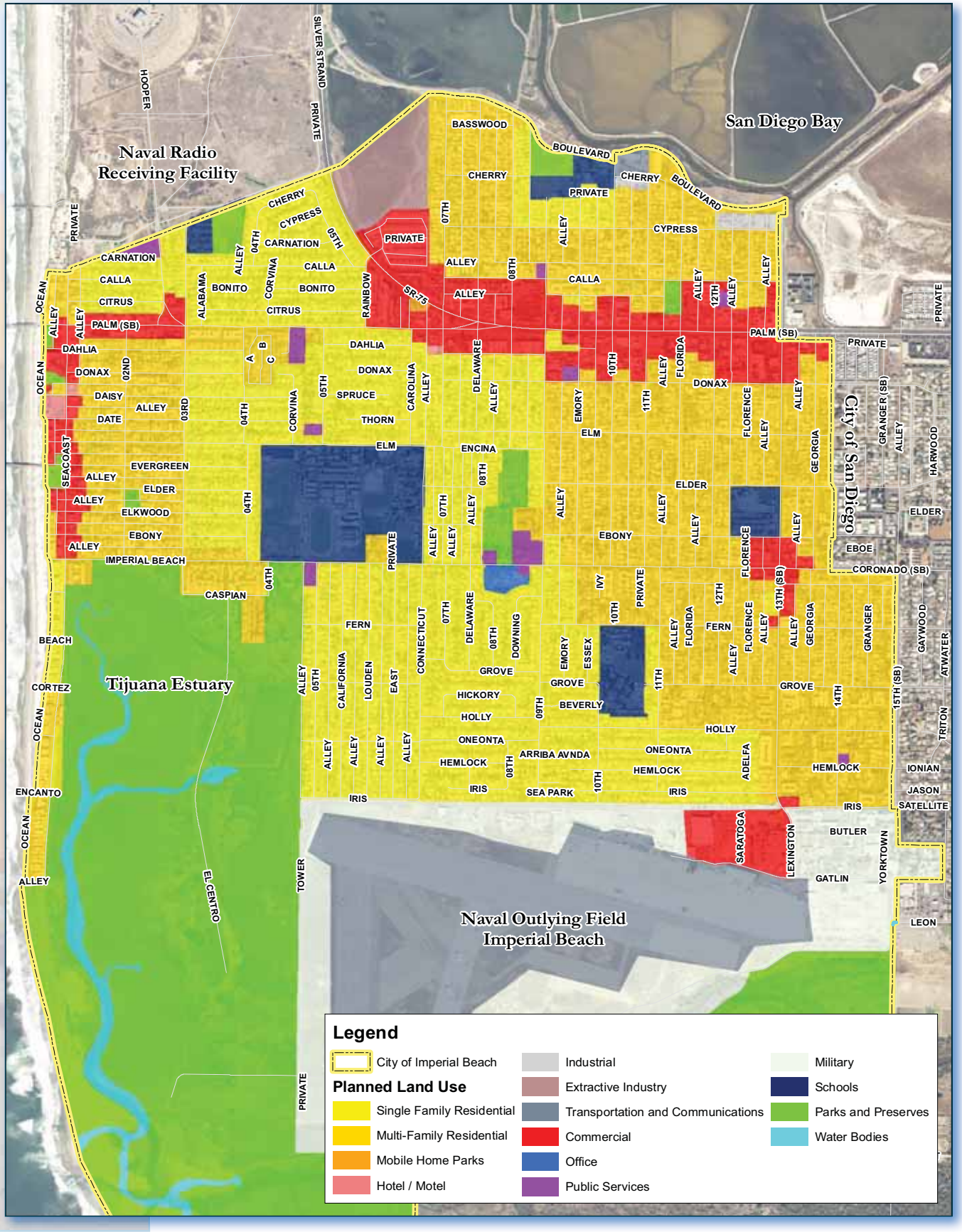
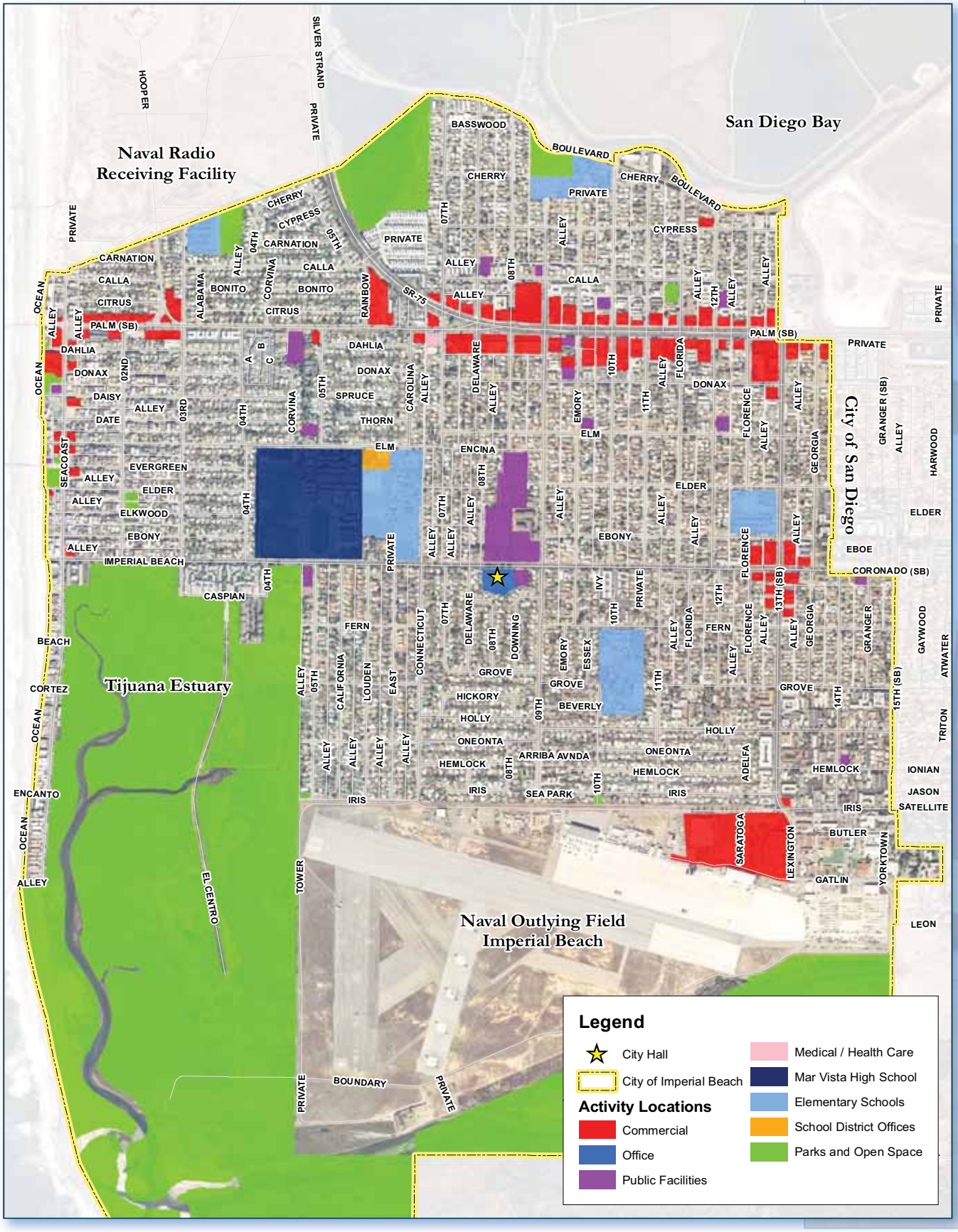


Figure 3.3 Activity Locations



4 Bikeway Facilities

4.1 Existing Bikeway Facilities and Connections

4.1.1 Class 1 Bayshore Bikeway

The Bayshore Bikeway is one of San Diego County's premier bikeway systems. This 26-mile bicycle facility will take cyclists around San Diego Bay through the Cities of San Diego, National City, Chula Vista, Imperial Beach and Coronado. Bicyclists can then return to downtown San Diego using the ferry service provided between Coronado and San Diego. Currently, approximately 13 miles of bicycle paths are in use on the Bikeway. The rest of the facility consists of on-street sections designated as either bicycle lanes or bicycle routes. The scenery is rich and varied and a nine-mile stretch along south and west sides of San Diego Bay follows the former Coronado Branch of the San Diego and Arizona Eastern Railroad. The rails are still visible in some places. The 0.81 mile section of bikeway within the City of Imperial Beach runs along the northern boundary between the City and the San Diego Bay. This Class 1 bike path is the only bike path within the City.

4.1.2 Class 2 Bike Lanes

There are no Class 2 bike lanes within the City limits. A bike lane exists on Palm Avenue east of 13th Street within the City of San Diego immediately adjacent to Imperial Beach.

Bayshore Bikeway looking east

4.1.3 Class 3 Bike Routes

According to SANDAG, there are three sections of Class 3 bike routes totaling 1.2 miles that can be found on 7th Street from the Bayshore Bikeway to Cypress Avenue, east on Cypress Avenue from 7th Street to 13th Street and 13th Street from the Bayshore Bikeway to Palm Avenue. The Class 3 route has been removed from Cypress Avenue based on the City of Imperial Beach General Plan. It stated that once the Bayshore Bikeway was complete, the east-west Cypress Avenue connection between 7th Street and 13th Street would be replaced by the Bayshore Bikeway.

4.2 Connections to Adjacent Cities

Bicycle facilities connecting with adjacent cities are along the Class 2 section of Palm Avenue which heads east to the City of San Diego and the Bayshore Bikeway which connects to the Silver Strand Bike Path and into the City of Coronado to the north and Chula Vista to the east. Coronado Avenue is a Class 3 bike route which ends its designation when it turns into Imperial Beach Boulevard at the City limit line.

4.3 Proposed Bikeway Facilities

4.3.1 Class 1 Bike Paths

Currently, the City of San Diego is developing a new section of bike path between Imperial Beach and Chula Vista that will replace the current routing along Palm Avenue in South Bay. Construction should being in late September 2007. Within the City of Imperial Beach General Plan, there are no proposed Class 1 bike paths other than the completion of the Bayshore Bikeway segment on the northern boundary.

4.3.2 Class 2 Bike Lanes

Class 2 bike lanes are proposed along sections of Palm Avenue between Third Street and Delaware Street and between Florida Street and 13th Street. Other routes include Rainbow Drive between SR-75 and Palm Ave, Imperial Beach Boulevard between Seacoast Drive and 13th Street, SR-75 between Rainbow Drive and Palm Avenue and 13th Street between the Bayshore Bikeway and Palm Avenue. The existing Class 3 bike route on 13th Street is proposed to be converted to a Class 2 bike lane.

View south from Bayshore Bikeway

4.3.3 Class 3 Bike Routes

Bike routes are proposed along several collector streets in the City. Proposed Class 3 routes are Seacoast Drive from Palm Avenue to the end at the cul-de-sac, Seventh Street south to Encina, west on Elm and south on Connecticut Street to Iris Avenue. Third Street from Imperial Beach Boulevard to Caspian Way, Caspian Way to the Tijuana Estuary Visitors Center, along the path to Grove Avenue, 5th Street from Grove Avenue to Iris Avenue, Iris Avenue from 5th Street to Connecticut Street and 9th Street from Palm Avenue to Imperial Beach Boulevard. Palm Avenue is a combination of bike lanes and bike routes. Bike routes are proposed between Seacoast Drive and Third Street and between Delaware Street and Florida Street.

4.3.4 Sidewalk Bicycle Route

The Circulation Element of the General Plan calls for a Sidewalk Bicycle Route on the sidewalks of Palm Avenue between 3rd Street and 7th Street. These sidewalks are proposed to be available for pedestrians.

4.3.5 Ecoroute Bikeway

The 1994 Imperial Beach General Plan states, “A special Ecoroute Bikeway shall be established to encompass Imperial Beach’s environmental assets including South San Diego Bay, the Tijuana River Estuary, the dunes on South Seacoast Drive, the beach, the pier and the breakwaters…Distinctive signage shall be developed to designate the route as well as a painted line on the pavement along the route…”

View southeast on trail skirting TENWR

4.4 Bicycle Collisions

Based on Statewide Integrated Traffic Records System (SWITRs), there have been 47 collisions involving bicyclists in the City of Imperial Beach between 2002-2005. Thirty-nine reported injuries and no fatalities occurred. Seventeen of the incidents involved children under the age of 16, or 36 percent of the incidents. The streets that had the most collisions are Imperial Beach Boulevard with eight, 13th Street with seven, SR-75 with six and Palm

Avenue with four. Numerous collisions occurred on streets with high ADTs such as Palm Avenue and Imperial Beach Boulevard between 9th Street to the eastern City limit. The occurrence of these collisions are also primarily on non-designated bikeway facilities, except for two incidents on the 13th Street Class 3 bike route between the Bayshore Bikeway and Palm Avenue.

4.5 1994 City of Imperial Beach General Plan Bikeway Policies

Policy C-15 Bikeways Plan
The General Plan proposes Seventh Street, a small segment of Encina Avenue and Connecticut Street as a Class 3 bike route.

The General Plan also proposes a "Sidewalk bike route" along Palm Avenue between Third and Seventh Streets.

Policy C-16 Ecoroute Bikeway
"A special Ecoroute Bikeway shall be established to encompass Imperial Beach's environmental assets including South San Diego Bay, the Tijuana River Estuary, the dunes on South Seacoast Drive, the beach, the pier and the breakwaters...Distinctive signage shall be developed to designate the route as well as a painted line on the pavement along the route. Opportunities for interpretive stations should occur along the route..." (See opposite page.)

Policy C-18 Sidewalk Bike Route
"The Palm Avenue sidewalks between Third and Seventh Streets shall be designated as Sidewalk Bike Routes. Such sidewalks shall be signed to encourage bicyclists but shall also remain available for pedestrians." (Note: This route type is not recognized by Caltrans and is recommended to be amended.)

Policy C-19 Bikeway Facilities Encouraged
"Bikeways shall be encouraged within the City and adjoining jurisdictions as a compliment to Imperial Beach's small town residential character and recreation emphasis, as an effective alternative to automobile travel, to maximize the impact of air quality and energy conservation and for the convenience of residents and visitors.

The City shall install bicycle storage facilities in public areas such as the beach, City Hall and parks and in other public facilities in order to encourage bicycle use. Bicycle storage facilities should be considered as a required condition of approval on new development applications for proposed commercial, hotel or major residential projects."

Figure 4.1 Existing and Programmed Bikeway Facilities

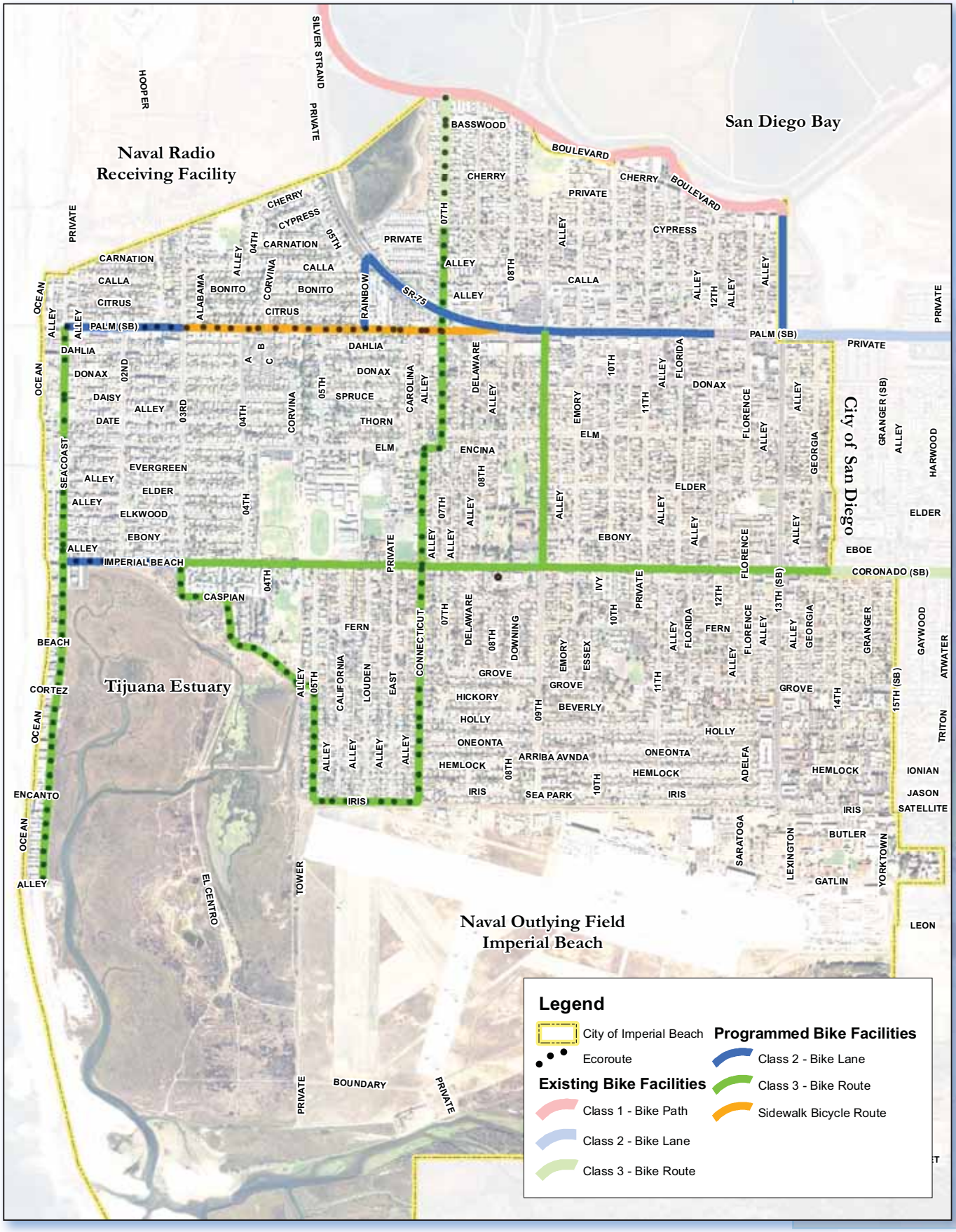
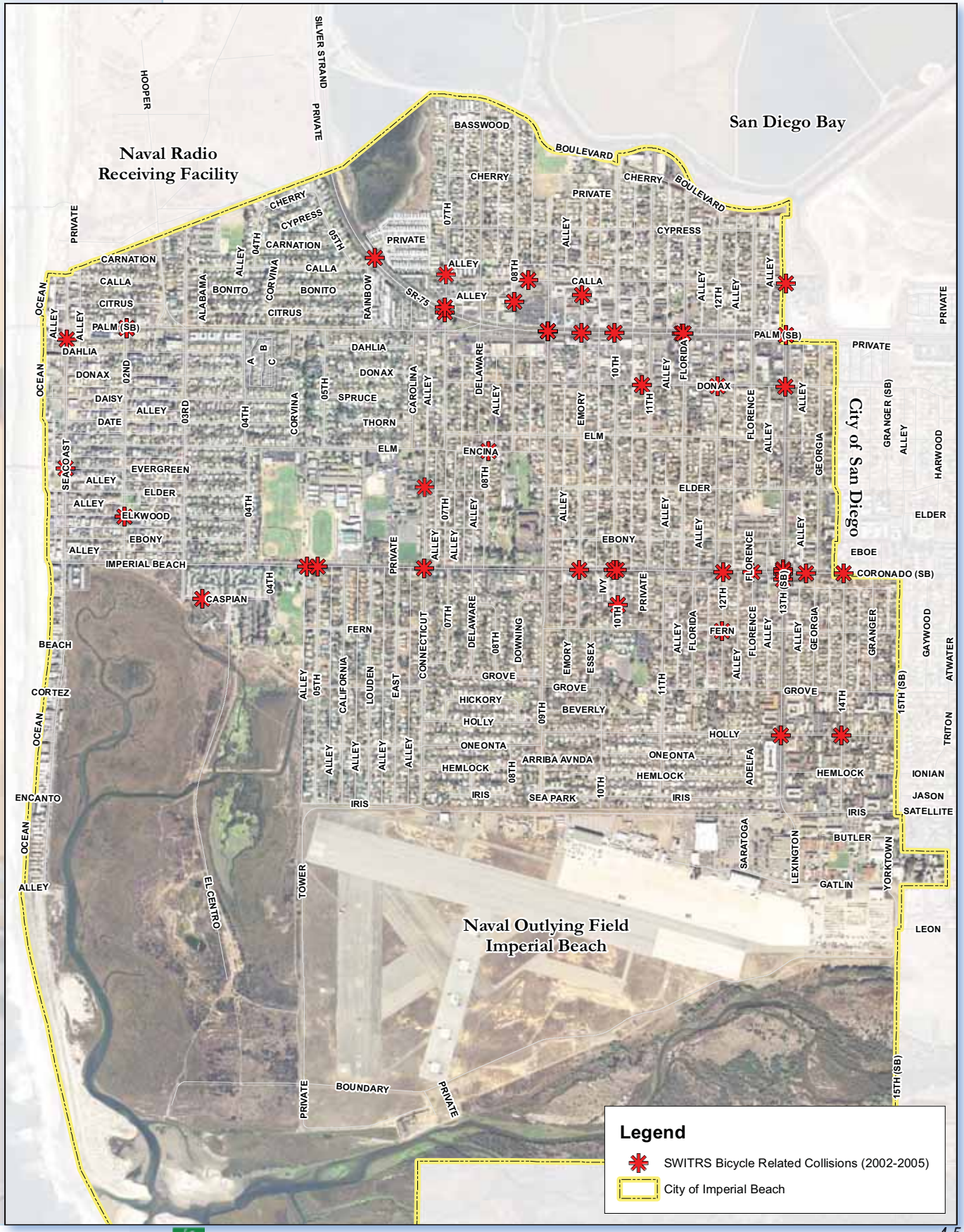


Figure 4.2 Bicycle Related Collisions

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5 Demographics

5.1 Demographics

Most of the population statistics used to perform the demographic analysis for this plan were derived from regional demographics data obtained from the U.S. Census Bureau. SANDAG provided the land use data needed to produce the maps and analysis for this chapter including the most recent 2020 projections. Data developed from elevation models and aerial photography was also used in the analysis. These data sources were primarily used for defining and evaluating existing and projected population, employment population and bike-to-work population.

5.2 Current Population Density (2000)

Based on the 2000 US Census, the population for the City of Imperial Beach was 26,992. According to SANDAG, estimates for the year 2006 is 27,563, or an increase of 2.1%. The areas of highest population density are on the western and eastern sides of the City since single family residential is predominantly within the center of the City. The highest population density is found in the southeastern most part of the City along 13th, 14th and 15th Streets between Grove Avenue and Iris Avenue, with at least 46 people per acre. Pockets of high density can be found on Caspian Way between 3rd and 4th Street, along Seacoast Drive near Imperial Beach Boulevard and along Calla Avenue in the northeastern portion of the City. Along the eastern edge of the City, bikeway facilities are not currently present to serve this population density.

5.3 Projected Population Density (2020)

The projected population for the City in 2020 is roughly 32,590, according to SANDAG's Regional Growth Forecast Update. The areas of highest population density will experience an even greater influx of people, according to SANDAG's GIS data. In the southeastern corner of the City, the density of some neighborhood blocks will rise to more than 60 people per acre, as well as pockets between Florida Street and Donax Avenue, and again along Calla Avenue. The western side of the City will also experience an increase in density since this area is being planned for more multi-family residential and mixed use.

5.4 Current Employment Density (2000)

The City of Imperial Beach is a relatively "commuter city" in which most of the population works outside of the city. Major employment centers within the City are commercial services and schools. Currently, areas with significant employment densities are the schools and the major commercial land uses along Palm Avenue. The corner of 13th Street and Imperial Beach Boulevard, City Hall, the corner of Seacoast Drive and Palm Avenue and along Seacoast Drive are other areas with high employment densities. These areas are also along commercial corridors, except for City Hall.

5.5 Projected Employment Density (2020)

The employment density projection does not indicate much change for 2020. Density increases are expected along Seacoast Drive where more commercial land use is planned. A few areas along Palm Avenue increase in density within the commercial corridor, particularly around the SR-75/Palm Avenue intersection. Current employment density for the remainder of the City remains essentially unchanged.

5.6 Bicycle Commuting

Residential land uses are by far the most common origin points for bicycle trips within a community, followed by bicycle trips originating in the residential areas of adjacent communities. Analyzing census housing density data is the primary method to determine what areas of a city will be most likely to generate bicycle trips. Logically, the higher the housing density, the more bicycle trips will be generated.

The bicycling trips originating in residential areas typically terminate at schools and employment centers, retail and entertainment centers, parks and open space, as well as at other residential areas. For this reason, the sizes, densities and locations of residential developments and their relationships to associated land uses such as schools, employment centers and parks and open space are crucially important to bikeway facility planning.

Most bicycle trips are likely to be for transportation (commuting to work or school), recreation and exercise purposes. All use categories are likely to occur throughout the City, but recreational riding may occur wherever streets are wider and where there are fewer cross streets and curb cuts. Commuter riding may occur anywhere as well, but commuters are more likely to be seen on the more direct routes utilizing major streets and arterials.

According to the 2000 Census data for commuting to work by bicycle, the City of Imperial Beach has a fair number of bicycle commuters scattered throughout the City. The largest density of bicycle commuters can be found along the Bayshore Bikeway between 7th and 10th Streets. Other such areas occur between 2nd and 4th Streets between Date Avenue and Palm Avenue, and east of Connecticut Street and 7th Street between 9th Avenue to the east and Donax Avenue and Imperial Beach Boulevard to the north and south. Other areas with potentially high numbers of bicycle commuters are along north Seacoast Drive and the southeastern part of the City. These pockets of bicycle commuting primarily correlate with areas of high population densities.

Cyclists along Imperial Beach Boulevard

Figure 5.1 2000 Population Density

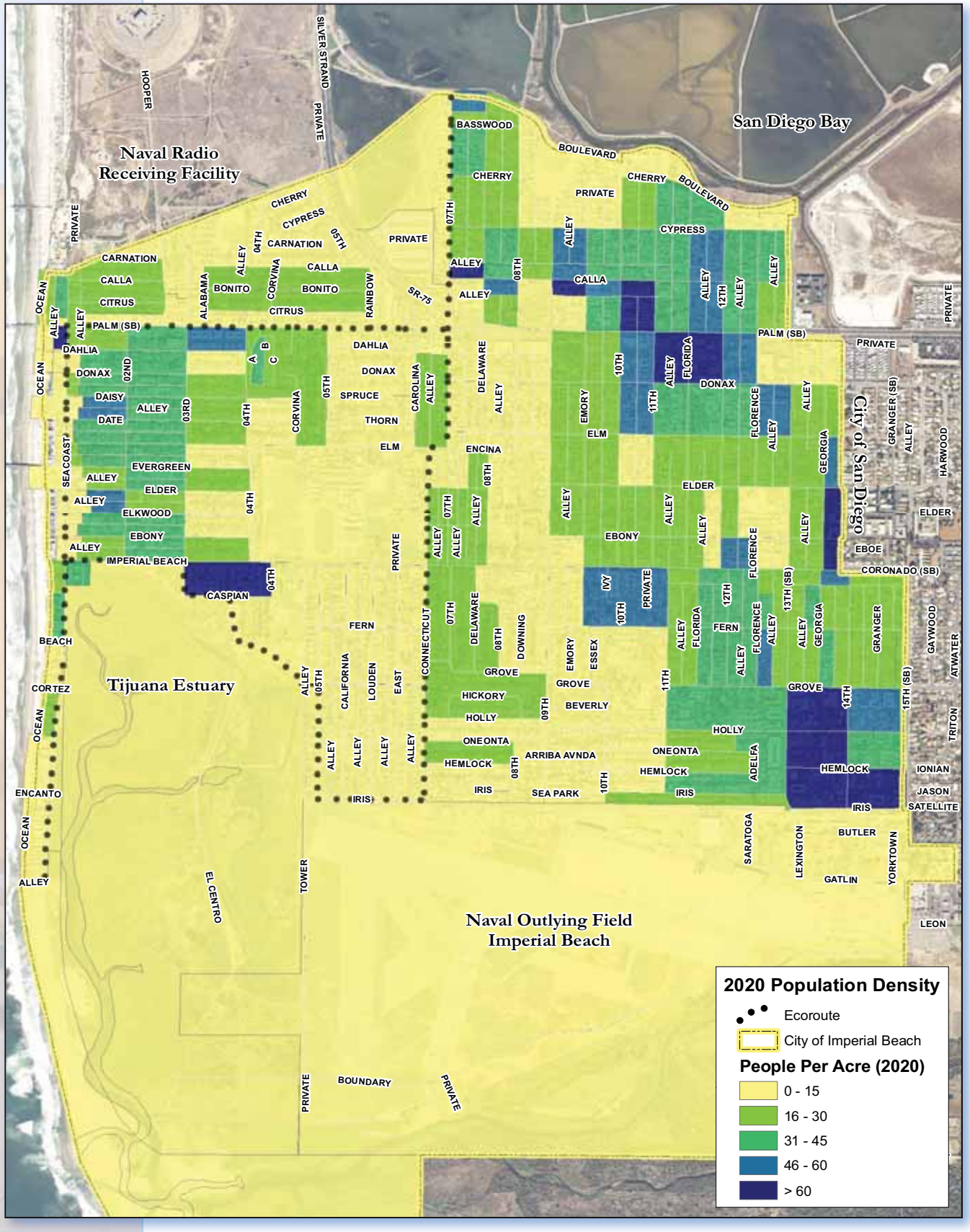


Figure 5.2 2020 Population Density

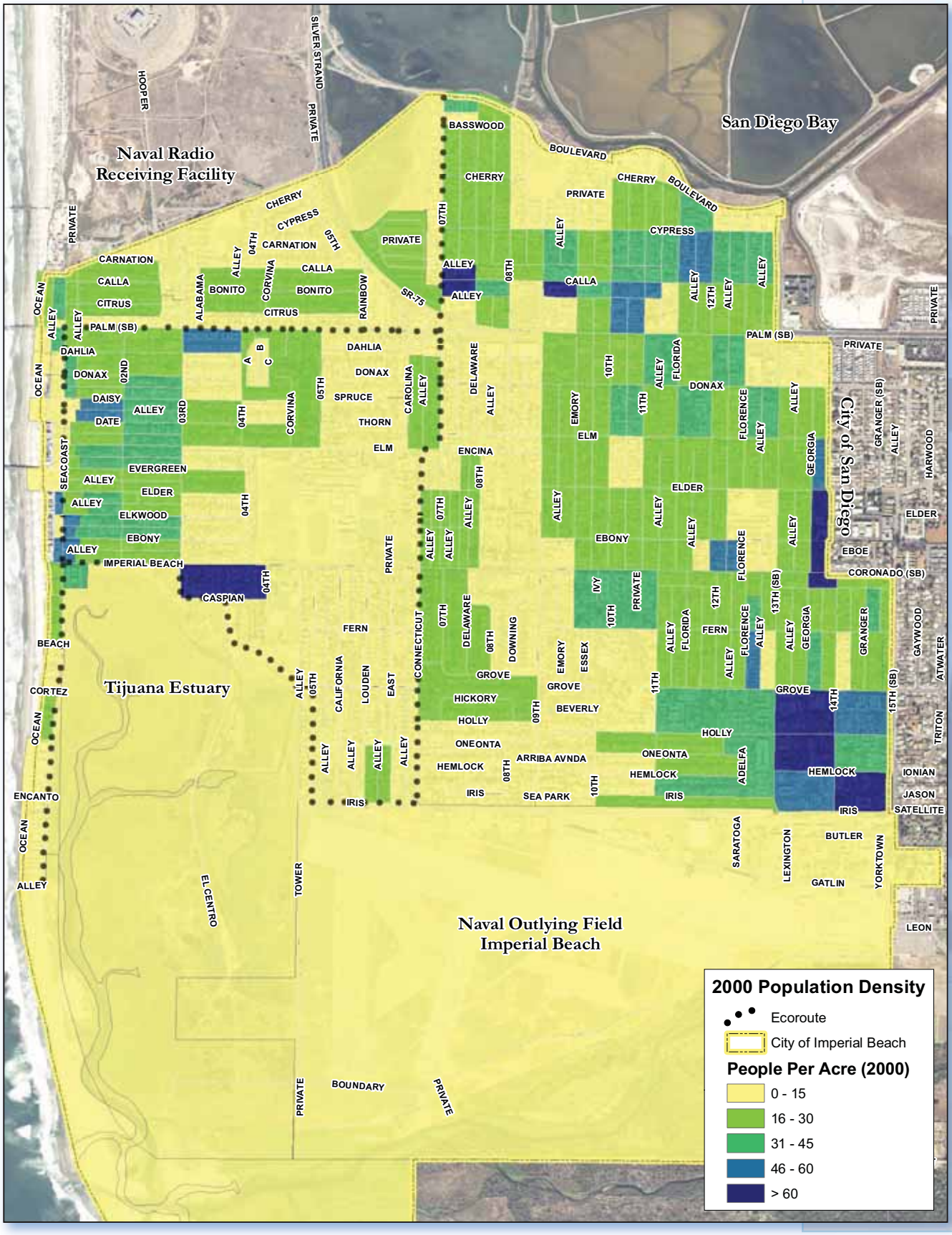


Figure 5.3 2000 Employment Density

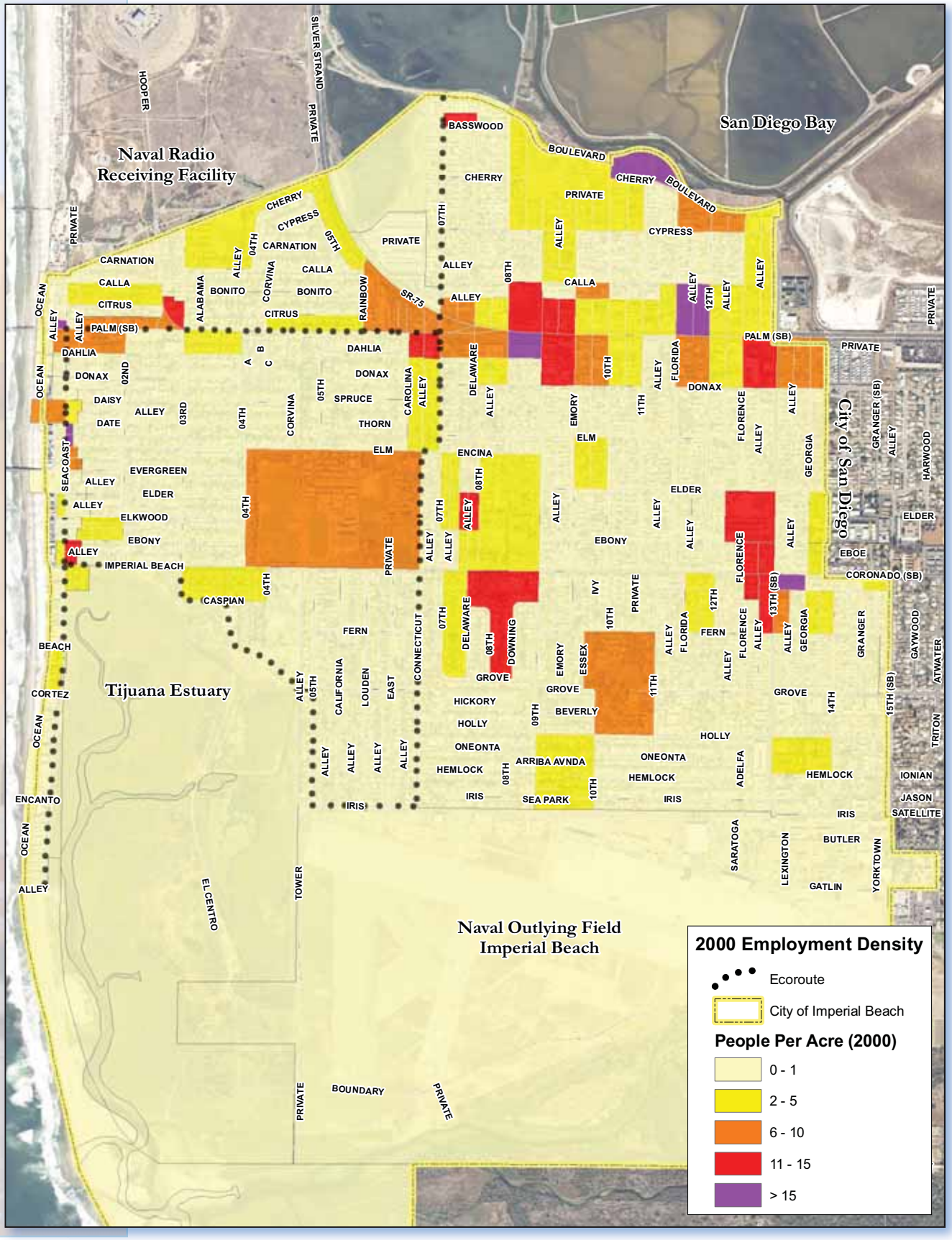


Figure 5.4 2020 Employment Density

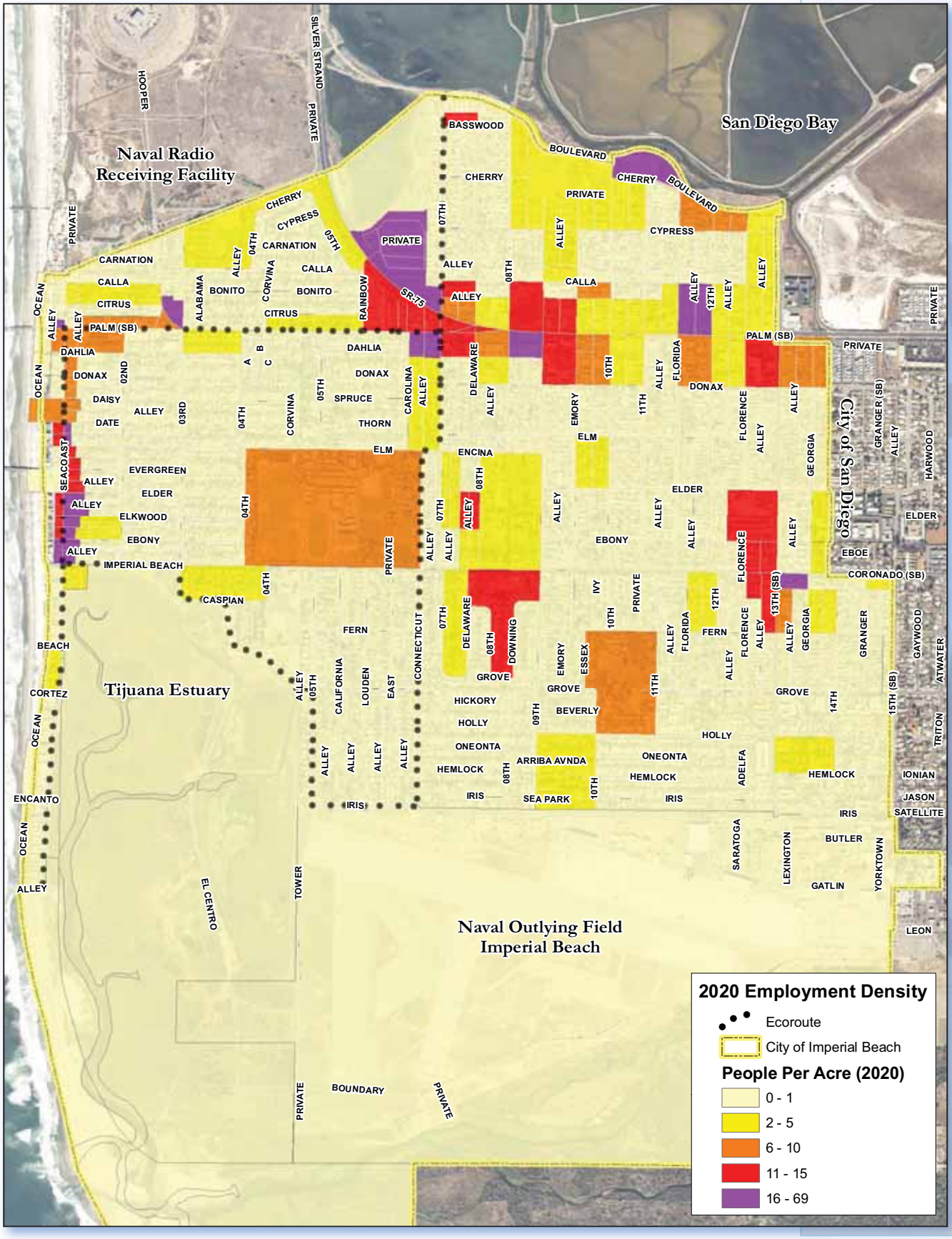
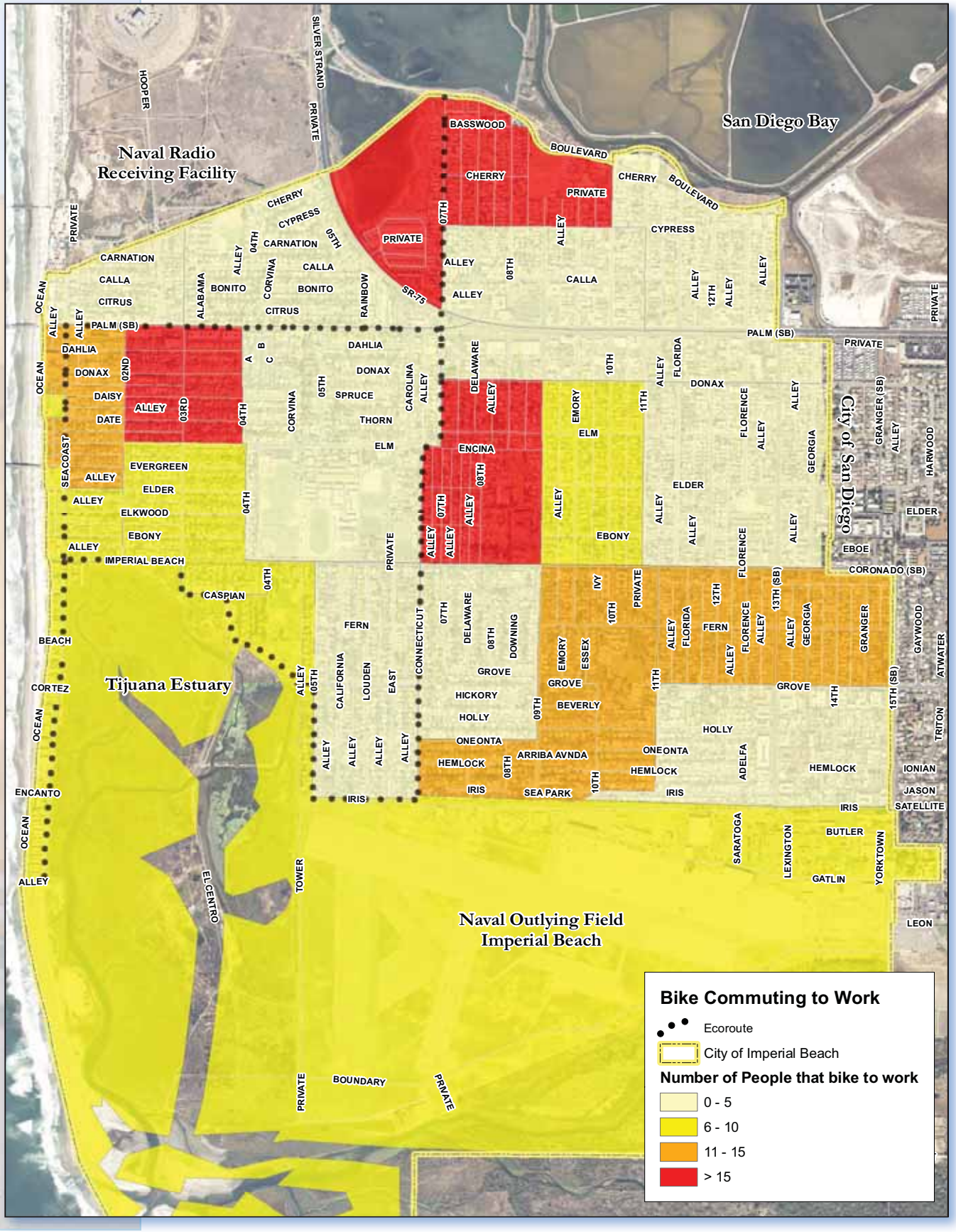


Figure 5.5 Bike Commuting Density

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6 Opportunities and Constraints

6.1 Opportunities

Some of the bikeway facilities proposed in this Bikeway Transportation Plan are updates to proposed routes from the City of Imperial Beach General Plan (1994). Whenever possible, routes were proposed to take advantage of opportunities to make connections between bicycle trip origin points and destinations throughout the City. These facilities will allow residents to more safely use their bicycles as another form of transportation, which could lead to many positive changes, such as better health and lower traffic volumes.

6.1.1 Topography

Compared to the other cities in San Diego County, the City of Imperial Beach has very little elevation change. The City is primarily flat to rolling with the highest points being roughly only 30 feet above see level. This relatively flat terrain is ideal for recreational cycling and commuting as bicyclists of all ages can navigate the streets without daunting hills to climb.

Imperial Beach Blvd. at Seacoast Drive

6.1.2 Street Network

The City's grid street pattern disperses traffic throughout the City, which helps to reduce volumes on major arterials. Cyclists can maneuver through the City using residential and side streets and only have to cross major arterials or collector streets instead of riding on them. For many novice cyclists and children, riding on high speed major arterials is a daunting task and may discourage some people from riding their bikes. The low motor vehicle volumes of most residential streets provide opportunities for cyclists to find the most comfortable route for their individual abilities.

Another advantage the City enjoys in terms of cycling, is that it does not have any freeways that cyclists must cross over or under. The closest freeway crossings to Imperial Beach are on Interstate 5 at Palm Avenue and Coronado Avenue, which are within the City of San Diego.

6.1.3 Destinations

Unknown to many recreational cyclists is the fact that the City of Imperial Beach has many points of interest beyond of the Bayshore Bikeway. Many cyclists riding the Bayshore Bikeway for recreational purposes will only ride to the end of the bikeway and turn around. The Tijuana Estuary, the parks and dining along Seacoast Drive, the beaches and Imperial Beach Pier are a few of the destinations that are not well known, but are easily accessible by bicycle. For the experienced cyclists who regularly train on the Bayshore Bikeway, places to eat and rest are important for long training sessions.

Imperial Beach Pier

Veterans Park

Tijuana Estuary Visitors Center

6 . 2 Constraints

6.2.1 High Traffic Volumes

The major arterials within the City have relatively high average daily traffic counts, particularly Palm Avenue and Imperial Beach Boulevard. These two arterials are the main connections to the City of San Diego to the east and to Interstate 5. The eastern segment of Palm Avenue between SR-75 and 13th Street has the highest traffic volumes of roughly 37,000 vehicles per day. Probably not coincidentally, this segment also has a highest incident of bicycle collisions on Palm Avenue. Traveling west on Palm Avenue to Seacoast Drive, motor vehicle volumes reduce down to 14,000 vehicles per day because many motorists continue north on SR-75 up the Silver Strand to the City of Coronado. Imperial Beach Boulevard east of 9th Street and 13th Street south of Palm Avenue also have high motor vehicle traffic volumes of between 10,000 to 15,000 average daily trips (ADTs). This segment of Imperial Beach Boulevard also experiences a high rate bicycle related collisions. Imperial Beach Boulevard west of 9th and 9th Street south of Palm Avenue have motor vehicle traffic volumes of between 6,000 and 8,100 ADTs. Fortunately, with the City's grid street network, cyclists usually have other route options and can usually avoid riding on major arterials without going too far out of their intended way, depending on their level of ability and desired destination.

6.2.2 Narrow Roadways

In many cases, the roadways within the City are too narrow to add Class 2 bike lanes or adjacent Class 1 bike paths. Residential streets are typically 36 feet wide with parking on both sides, which leaves roughly 10 foot lanes in each direction. Bike lanes are required to be five feet wide if there is a curb present, which would limit the travel lane to only five feet, impossible for vehicles.

Seacoast Drive

Many of the major collectors and arterials are also too narrow to add bike lanes since there is generally on-street parking along these streets. With the exception of west Imperial Beach Boulevard, which has wide lanes in each direction, there are few opportunities to add bike lanes. However, options such as a shared bike lanes and Class 3 bike routes are still feasible.

6.2.3 Lack of Amenities along the Bayshore Bikeway

During field investigations and in community meeting comments, it was noted that amenities such as restrooms, eateries and bike parking were lacking on or near the Bayshore Bikeway. There are no public restrooms at the 7th, 8th, 12th and 13th Street entrances to the Bayshore Bikeway. The closest public restroom along the Bikeway is at Coronado's Ferry Landing. Cyclists and pedestrians alike currently must go to Palm Avenue and either use a gas station or restaurant restroom. This is especially a concern for families that travel the Bayshore Bikeway with their children. The lack of bike parking is also a concern for those who wish to lock up their bikes at the entrances. This would be a particular concern if restrooms, even portable restrooms, were in place. Also noted was a lack of kiosks with maps and information on local restaurants and other Imperial Beach sites of interest. Such informative kiosks and signage would also allow users to choose which route they would like to take to their desired destination.

Bayshore Bikeway at 7th Street

Bayshore Bikeway at 13th Street

Figure 6.1 Topography

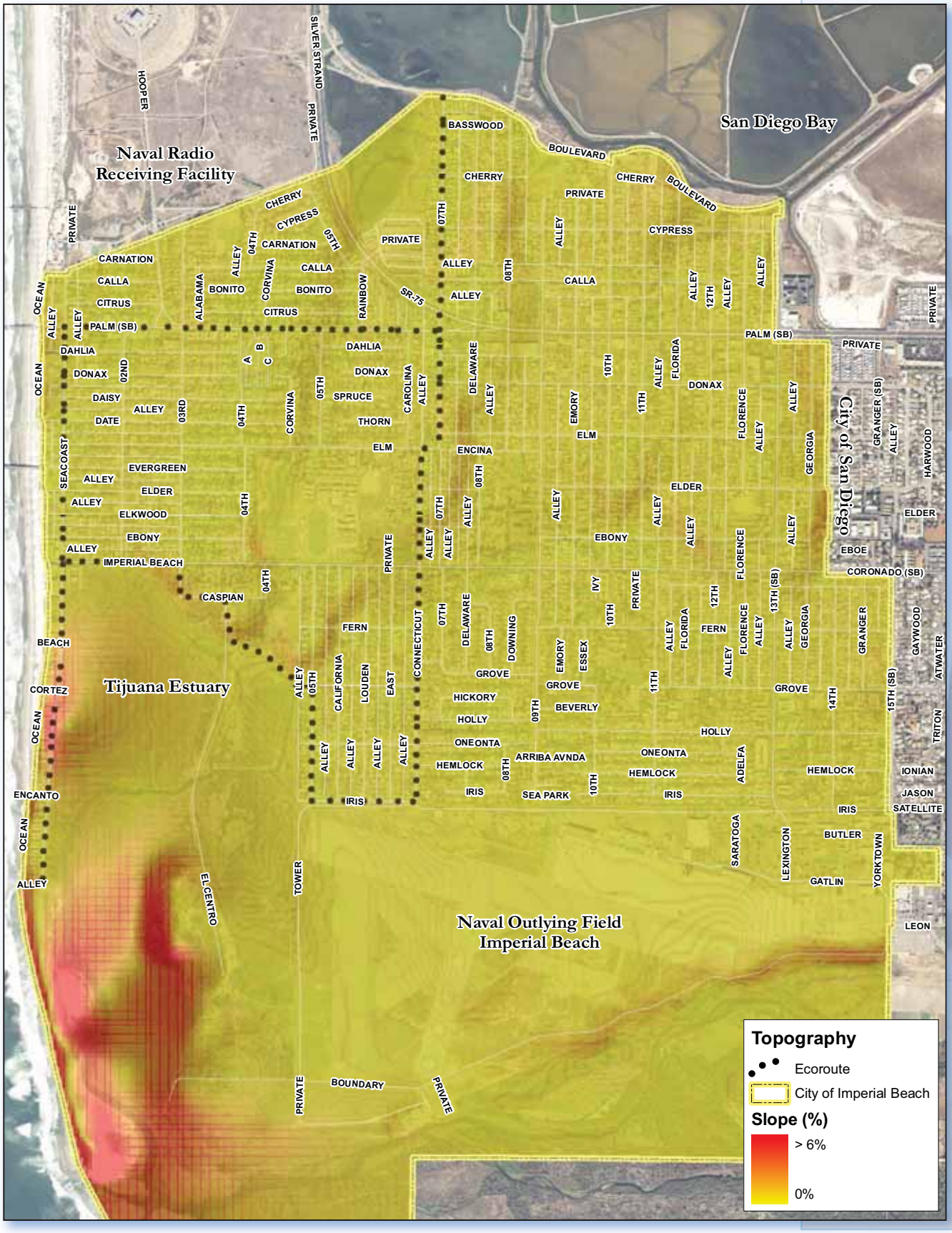
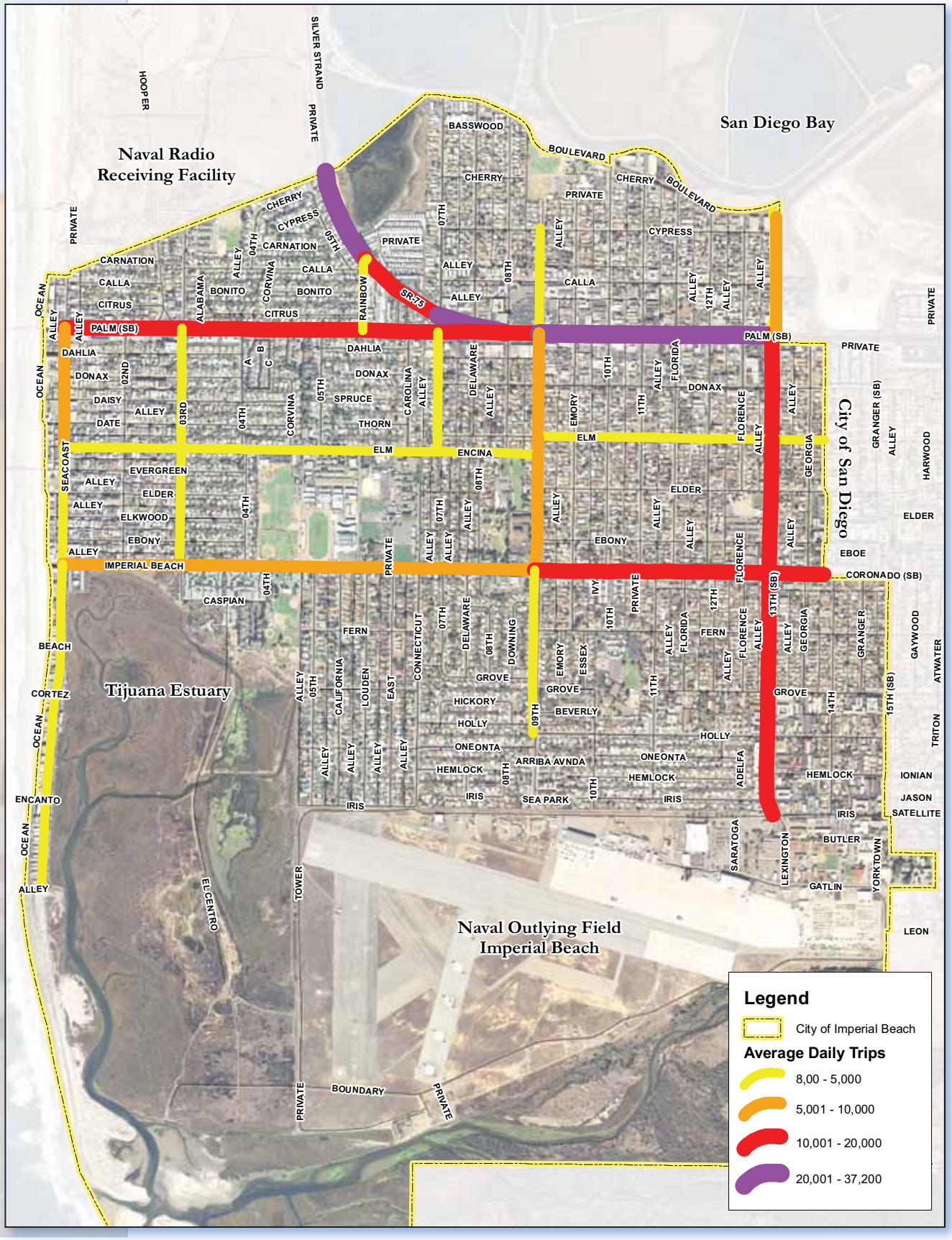


Figure 6.2 Average Daily Trips (ADTs)

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7 Analysis and Recommendations

7.1 Segment Analysis

As the focus of this study, the following segments have been evaluated for bikeway suitability. These segments have been proposed to be added to the City of Imperial Beach bikeway system.

7.1.1 Seventh Street

Segment: Between Bayshore Bikeway and Elm Avenue
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route
ADT: 1,700
Speed Limit: 25 MPH
Length: 0.8 Miles
Vehicle Lanes: 2
Parking: On-street parallel

View south from the Bayshore Bikeway

Seventh Street is a primary access point to the Bayshore Bikeway and the beginning of the programmed Ecoroute Bikeway from the north. This 40 foot wide street is programmed as a Class 3 bike route and is recommended to remain in that configuration due to low traffic volumes and street width. This roadway connects to Palm Avenue, where cyclists can turn onto Palm and follow the Ecoroute to the beach area. One option that can be added to this system is a Class 2 bike lane within the short segment between Palm Avenue and SR-75. This would allow users unfamiliar with the route to more safely pass through this segment with its two signalized intersections. Additional signage would also be appropriate here to inform users of the Ecoroute. This section of roadway passes through an area with a high number of bicycle commuters, according to the US Census Bureau.

Seventh Street at Palm Avenue/Silver Strand - view south below

7.1.2 Palm Ave

Segment: Between Seacoast Drive and Twelfth Street
Programmed Bicycle Facility: Class 2 Bike Lane and Sidewalk Bicycle Route
Recommended Bicycle Facility: Class 2 Bike Lane and Class 3 Bike Route
ADT: 14,600 – 37,200
Speed Limit: 45 MPH
Length: 1.4 Miles
Vehicle Lanes: 2-6
Parking: On-street parallel

The 1994 Circulation Element of the City General Plan calls for Class 2 bike lanes between Thirteenth and Seventh Streets. Currently, there are no Class 2 facilities in the City of Imperial Beach. Between Seventh and Third Streets, the Circulation Element called for a "sidewalk bicycle route" and Class 2 bike lanes continuing from Third Street to Seacoast Drive. The California Department of Transportation (CALTRANS), the organization that must approve the City's BTP and also administers federal funding for bicycle projects within the state, does not recognize a sidewalk bicycle route. For this reason alone, it is not recommended that it be implemented.

Additionally, sidewalk bicycle routes are not suited for cyclists since they could encounter conflicts with pedestrians, utility poles, sign posts, benches, etc. Along Palm Avenue, cyclists would face conflicts at driveways, alleys and intersections. A cyclist on a sidewalk is generally not as visible to motorists and can emerge unexpectedly. This is especially true of cyclists who ride in the direction opposing adjacent motor vehicle traffic. Drivers do not expect a vehicle coming from this direction and cyclists are put into awkward situations at intersections where they cannot safely act like a vehicle, but are not in the pedestrian flow either, which creates confusion for other users. Cyclists are generally safer when they operate as roadway vehicles, rather than as pedestrians.

View west at Rainbow Drive

Class 2 bike lanes and Class 3 bike routes are recommended because ADTs are high enough to warrant a separate bicycle facility and will also provide a traffic calming effect. Due to current projects and right-of-way issues, Class 2 bike lanes are recommended between Third Avenue and Delaware Street and between Florida Street and Thirteenth Street. Class 3 bike routes are recommended between Seacoast Drive and Third Street and between Delaware Street and Florida Street. Because posted speed limits are in excess of 35 MPH, shared lane road markings or 'Sharrows" can not be used on Palm Avenue. The Class 3 bike routes segments will complete the bikeway system on Palm Avenue even though they are two separate facility types. Cyclists who ride into the City will have a better sense of safety riding along Palm Avenue to access the beach or other attractions. Whenever possible, bicycle-actuated signals should be placed within the bike lane so traffic signals will recognize bicycles.

7.1.3 Seacoast Drive

Segment: Between Palm Avenue and Cul-de-Sac
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route with Shared Bike Lane Markings
ADT: 2,000 – 5,300
Speed Limit: 25-35 MPH
Length: 1.2 Miles
Vehicle Lanes: 2
Parking: On-street parallel, angled and 90-degree parking

View south from Palm Avenue

The shared lane marking is an addition to the typical signage only Class 3 bike route implementation. It is an effective, flexible alternative to striped bike lanes and can be used to improve cyclist safety and make connections between bike lanes, greenways and bridge paths on streets too narrow for standard five-foot wide bike lanes. In 2003, the San Francisco Department of Parking and Traffic surveyed motorists and cyclists about "shared lane" bike symbols and found that 80% of respondents understood the symbols to mean "share the road" and drive and ride cautiously.

This shared lane marking can be implemented along Seacoast Drive where the roadway is relatively narrow and on-street parking is present. The programmed bicycle facility for Seacoast Drive is a Class 3 bike route where signage along the street will inform drivers that the road at anytime may have numerous cyclists. Because of the on-street parking, parked cars can obstruct the view of signs informing drivers of potential cyclists. On such a narrow roadway, cyclists wishing to stay out of the way of motor vehicles often ride too close to parked vehicles and risk being hit by opening vehicle doors (being "doored"). To help alleviate this problem, a logo is placed on the road-way surface within the shared travel lane. The use of this pavement logo in conjunction with "Share the Road" signs and bicycle route signs can reinforce that cyclists belong on the road and will increase driver awareness of cyclists. Where there is a traffic signal, a bicycle-actuated signal, such as a diagonal quadrupole loop, can be installed on streets with high levels of cycling activity.

View north from the cul-de-sac

View north from Imperial Beach

Example of a Shared Lane symbol in New York City

7.1.4 Imperial Beach Boulevard

Segment: Between Seacoast Drive and City of San Diego City Limit
Programmed Bicycle Facilities: Class 2 Bike Lane between Seacoast Drive and Third Street, Class 3 Bike Route between Third Street and City Limit
Recommended Bicycle Facility: Class 2 Bike Lane
ADT: 8,000 – 15,000
Speed Limit: 35 MPH
Length: 2 Miles
Vehicle Lanes: 2-4
Parking: On-street parallel

Imperial Beach Boulevard is programmed as a Class 2 bike lane between Seacoast Drive and the City limit with the City of San Diego. This bicycle facility is still feasible, but on-street parking from Connecticut Street to the City limit will need to be removed or traffic lanes reduced from two lanes to one. High motor vehicle traffic volumes along this major collector street warrant a specific bicycle facility because Imperial Beach Boulevard also experiences a high rate of bicycle related collisions. As a major east-west connection, this facility is another option of travel if the destination is the City of San Diego to the east or the beaches to the west. Also along Imperial Beach Boulevard are major destination points such as the Tijuana Estuary, Mar Vista High School, City Hall, Veterans Park, Sports Park and the public library.

View west from Florida Street

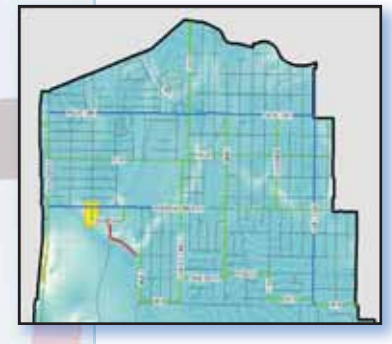
Due to the wide one lane roadway between Seacoast Drive and Connecticut Street, a Class 2 bike lane would fit between the travel lane and the on-street parking. The current width of the roadway is 64 feet and parking, medians and lane widths vary along the roadway. Parking would have to be removed in the eastbound direction between Third and Connecticut Streets because the roadway width is not as wide as in the west bound direction. The westbound direction can accommodate a bike lane in its current configuration.

View east from Seacoast Drive

7.1.5 State Route 75 and Palm Avenue

Segment: Between Rainbow Drive and Delaware Street
Programmed Bicycle Facilities: Class 2 Bike Lane
Recommended Bicycle Facility: Class 2 Bike Lane
ADT: 25,000 – 33,000
Speed Limit: 45 MPH
Length: 1,753 Feet
Vehicle Lanes: 4

Class 2 bike lanes are recommended through this section to connect the proposed Class 1 bike paths along the Silver Strand to Palm Avenue. Bike lanes will also act as a traffic calming measure when entering the City from State Route 75.

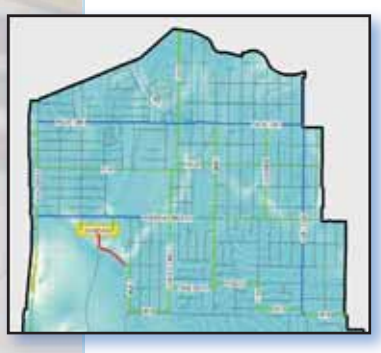


7.1.6 Third Street

Segment: Between Imperial Beach Boulevard and Caspian Way
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 388 Feet
Vehicle Lanes: 2
Parking: None

View south from Imperial Beach Boulevard

This two-way street connects Imperial Beach Boulevard and Caspian Way. It does not have any on-street parking and is too narrow to add a Class 2 bike lane. Its low motor vehicle traffic volumes therefore warrant a Class 3 bike route on this roadway segment.



7.1.7 Caspian Way

Segment: Between Third Street and Fourth Street
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.2 Miles
Vehicle Lanes: 1-2 (One way from Tijuana Estuary entrance to Fourth Street)
Parking: On-street parallel with 90-degree parking between Tijuana Estuary entrance and Fourth Street

Caspian Way is a two-way street between Third Street and the Tijuana Estuary Visitors Center entrance and becomes one-way westbound between Fourth Street and the Tijuana Estuary Visitors Center entrance. It is recommended that Caspian Way east of the Visitors Center entrance be converted to a two-way street to allow cyclists a continuous route and access to the Sports Park and the Visitors Center. The 90-degree parking along the south side of Caspian will need to be removed to accommodate the Class 3 bike route. On-street parking on the south side will need to be converted to eastbound on-street parking. Bicycle travel in the opposite direction of traffic is deemed unsafe since drivers may not be expecting bicycle traffic coming in their direction or even present on the road. Riding a bicycle against traffic is contrary to the rules of the road and the leading cause of bicycle/motor vehicle collisions.

View east from 3rd Street

Because this section is very short, another alternative is that signage may be sufficient to allow cyclists to more safely travel in the opposite direction as long as drivers are warned ahead of time to share the road and yield to oncoming bicycle traffic. The 90-degree parking would have to be redesigned to angled parking to allow drivers backing out the ability to see oncoming cyclists heading east from the Visitors Center. Obstructions to line-of-sight from cyclists turning eastbound on Caspian will need to be addressed. Improving sight lines is important at the Caspian Way and Visitors Center intersection.

View west from 4th Street

7.1.8 Fourth Street

Segment: Between Caspian Way and Imperial Beach Boulevard
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 388 Feet
Vehicle Lanes: 1
Parking: On-street parallel and angled parking

Fourth Street is an important connection to the overall flow of the bikeway system. Currently, Fourth Street is one-way with the Sports Park to the east and multi-family residential to the west, with angled and parallel parking on both sides of the street. Because of the one-way nature of the street, a bicycle facility cannot be implemented for cyclists to travel in the opposite direction to access Imperial Beach Boulevard from the Tijuana Estuary Visitors Center unless they go through the Sports Park. Recommendation is to allow two-way access so the street can accommodate a Class 3 bike route. The angled or parallel parking will have to be re-designed or removed to allow for a bicycle facility.

7.1.9 Off-street route through Tijuana Estuary

Segment: Between Caspian Way and Grove Avenue
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 1 Bike Path
ADT: N/A
Speed Limit: N/A
Length: 0.3 Miles
Vehicle Lanes: N/A
Parking: N/A

View east from the TENWR Visitors Center

With permission from the Department of Fish and Wildlife and California State Parks, a Class 1 bike path is recommended from the Tijuana Estuary Visitors Center Parking lot along the paved path and terminates onto Grove Avenue. This would complete the Ecoroute since this is currently the only existing unpaved segment of the route. The bike path will allow those on traditional road bikes and even wheelchairs to make the connection and continue on the Ecoroute, or just traverse the north end of the estuary.

7.1.10 Fifth Street

Segment: Between Grove Avenue and Iris Avenue
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.3 Miles
Vehicle Lanes: 2
Parking: On-street parallel

View south from Grove Avenue

This residential street connects the Grove Avenue estuary entrance to the Iris Avenue estuary entrance and is also part of the Ecoroute.

7.1.11 Iris Ave

Segment: Between 5th Street and Connecticut Street
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.2 Miles
Vehicle Lanes: 2
Parking: On-street parallel, north side only

The western terminus of Iris Avenue is a three car parking lot with one disabled space at an access point to the Tijuana Estuary trail system. Bicycles are allowed on the southern trail segments. A map kiosk and signage exists to assist trail users. Iris Avenue runs along the northern fence line of the Naval Outlying Landing Field (NOLF) Imperial Beach. The north side of the street accommodates street parking but on the south side, the NOLF fence lies immediately adjacent to the roadway and parking is not allowed.

View east from 5th Street

7.1.12 Connecticut Street

Segment: Between Iris Avenue and Elm Avenue
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 35 MPH
Length: 0.9 Miles
Vehicle Lanes: 2
Parking: On-street parallel

This north-south segment of the Ecoroute connects Iris and Elm Avenues and is adjacent to single-family residential. If bicycle volume is increased, it can be transformed into a Class 3 route with shared lane markings.

View south from Elm Avenue

7.1.13 Oneonta Avenue

Segment: Between Connecticut Street and 9th Street
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.3 Miles
Vehicle Lanes: 2
Parking: On-street parallel

This road is the Ecoroute connection between Connecticut and 9th Streets and accesses the bus stops on Ninth Street and Holly Avenue. The surrounding land use is single-family residential, and according to the U.S. Census, this segment of Oneonta Avenue supports a significant number of bicycle commuters.

7.1.14 Holly Avenue

Segment: Between 9th Street and 11th Street
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.3 Miles
Vehicle Lanes: 2
Parking: On-street parallel

This section of Holly Avenue has two bus tops and is adjacent to single-family residential. This segment connects Ninth and Eleventh Streets.

7.1.15 Eleventh Street

Segment: Between Holly Avenue and Iris Avenue
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.1 Miles
Vehicle Lanes: 2
Parking: On-street parallel

Eleventh Street connects Holly and Iris Avenues and has three bus stops along its short span. The area west of Eleventh Street supports a medium to high number of bicycle commuters, according to U.S. Census data.

7.1.16 Iris Avenue

Segment: Between 11th Street and 13th Street
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.3 Miles
Vehicle Lanes: 2
Parking: On-street parallel

This section has two bus stops with adjacent single- family residential land use. This segment connects with Thirteenth Street and access to Imperial Beach NOLF.

7.1.17 Iris Avenue

Segment: Between 13th Street and City Limit
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.2 Miles
Vehicle Lanes: 2
Parking: On-street parallel, north side only

Iris Avenue connects 13th Street to Satellite Boulevard in the City of San Diego. This is the southernmost bikeway connection with the City of San Diego. Traffic is very light on this roadway segment and a Class 3 bike route would be sufficient as a bicycle facility since it connects to Imperial Beach NOLF and Thirteenth Street. Projected population density along this section of Iris Avenue is also one of the highest in the City and therefore probably warrants a bicycle facility.

7.1.18 Thirteenth Street

Segment: Between Bayshore Bikeway and Iris Avenue
Programmed Bicycle Facility: Class 2 Bike Lane between the Bayshore Bikeway to 13th Street
Recommended Bicycle Facility: Class 2 Class 2 Bike Lane between the Bayshore Bikeway and Iris Avenue
ADT: 5,000 – 12,500
Speed Limit: 35 MPH
Length: 1.3 miles
Vehicle Lanes: 2-4
Parking: On-street parallel and 90-degree parking

This fairly high volume street is the easternmost north-south route in the City. Because of the number of street traffic and bicycle related collisions that occur on this segment, a Class 2 bike lane is recommended to assist in traffic calming and to provide a separate facility for cyclists wanting to access the Bayshore Bikeway from the east. On-street parking would have to be removed to accommodate the bike lanes.

View south from Cypress Avenue

7.1.19 Florida Avenue

Segment: Between Palm Avenue and Imperial Beach Boulevard
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: 0.5 Miles
Vehicle Lanes: 2
Parking: On-street parallel

This roadway would be another north-south route within a mix of multi-family and single-family land use. This segment is a connection across Palm Avenue between Ninth and Thirteenth Streets. Projections indicate that land use along Florida Street will become primarily multi-family with its associated population increase. This route would serve as another north-south option between Palm Avenue and Imperial Beach Boulevard. Florida Street does not have a direct connection across Imperial Beach Boulevard so cyclists will have to use Thirteenth or Ninth Streets to cross it. However, there is a direct crossing at Palm Avenue. There are stop signs on Florida Avenue and none on the cross streets. This could be a hazard if novice cyclists and children did not follow traffic laws and ignored the stop signs because drivers coming from the east or west could collide with the cyclists since they have the right-of-way and are not required to stop. For this to be a viable bicycle facility, all the intersections should become four-way stops.

7.1.20 Ninth Street

Segment: Between Palm Avenue to Holly Avenue
Programmed Bicycle Facility: Class 3 Bike Route
Recommended Bicycle Facility: Class 3 Bike Route
ADT: 3,800 – 6,700
Speed Limit: 25-35 MPH
Length: 0.9 Miles
Vehicle Lanes: 2-4
Parking: On-street parallel and angled parking

View south from Elm Avenue

Ninth Street is a central north-south connection between the Palm Avenue and Imperial Beach NOLF to the south. A Class 3 bicycle route is recommended here because traffic volume is not very high and the surrounding area's land use is primarily residential. Because of the on-street parking, shared lane markings can also be used along Ninth Street.

7.1.21 Elm Avenue

Segment: Between Seacoast Drive and City of San Diego City Limit
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route and eventually a Shared Bike Lane depending on level of use
ADT: 1,500 – 3,100
Speed Limit: 25 MPH
Length: 1.4 Miles
Vehicle Lanes: 2
Parking: On-street parallel

Elm Avenue was suggested as a bicycle facility in community meeting comments, including designation as anything from a Class 3 bike route to a Class 1 bike path. After further field analysis, it is apparent that Elm Avenue does have an intrinsic benefit as a bicycle facility. It is a low volume east-west alternative to Imperial Beach Boulevard and Palm Avenue midway between them. Though there are a number of alleys and street intersections to contend with, this segment's width, low traffic volume and connectivity makes it a viable bicycle facility. However, Elm Avenue is only 36 feet wide with on-street parking on both sides. This leaves only 20 feet of motor vehicle lane width (10 feet each way) and therefore not enough room for a bike lane. However, most of Elm Ave is an 80-foot right-of-way (22 feet from curb to property line on each side).

View east from Connecticut Street

The surrounding land use is residential so land acquisition for a Class 1 bike path is not a practical solution. A recommendation for this route is a Class 3 bike route. If bicycle use along Elm Avenue increased as a bike route, shared lane markings can help prevent cyclists from riding in the parked vehicles' "door zone" so they will ride further out in the street than immediately adjacent to parked cars. The shared lane markings are most useful where parking turnover is high, so this may not be necessary on this segment.

7.1.22 State Route 75: Alternative #1

Segment: West side of State Route 75 to Silver Strand Boulevard
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 1 Bike Path
ADT: N/A
Speed Limit: N/A (65 MPH on SR-75)
Length: 0.75 Mile
Vehicle Lanes: N/A
Parking: N/A

This proposed section is to provide an access to Seacoast Drive without having to traverse Palm Avenue. A pedestrian bridge is recommended to allow users on the Bayshore Bikeway to cross SR-75 safely and onto a bike path on the west side of SR-75. A traffic signal and crosswalks could also be implemented, but traffic calming measures will need to be installed because the posted speed limit on SR-75 is 65 MPH. A bridge would allow an uninterrupted flow of traffic for cyclists, pedestrians and vehicles alike. The right-of-way along SR-75 is fairly narrow and acquisition of land from the US Navy will need to be explored. The existing fence would need to

be moved into the Naval Radio Receiving Facility (NRRF) to allow the eight-foot wide bike bath with a two-foot buffer from the road. (For any buffer width of less than 50 feet, state law requires a physical barrier, such as a guardrail.)

As the bike path enters the City, the route turns westward along the northern City limits behind private residences. Here too, land acquisition from the Navy to allow a bike path will need to be coordinated because this private property lies adjacent to the NRRF. The bike path would end on Silver Strand Boulevard, which is also the entrance to the NRRF. An access onto Third Street is recommended for use by residents to access West View Elementary School. Utilization of the existing perimeter road along this route would be a viable option if an agreement can be reached with the Navy.

7.1.23 State Route 75: Alternative #2

Segment: West side of State Route 75 to Rainbow Drive
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 1 Bike Path
ADT: N/A
Speed Limit: N/A
Length: 0.6 Mile
Vehicle Lanes: N/A
Parking: N/A

This route is a continuation of State Route Alternative #1 if an agreement with the Navy to provide access to Silver Strand Boulevard can not be reached. Users would travel further south to Rainbow Drive where it continues as a Class 3 Bike Route to access Palm Avenue. This alternative also allows a shorter route to Palm Avenue and to the beaches than continuing on to Seventh Street and Palm Avenue. This segment is wide enough to accommodate an eight-foot path with two-foot buffers on each side.

7.1.24 State Route 75: Alternative #3

Segment: East side of State Route 75 to Rainbow Drive
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 1 Bike Path
ADT: N/A
Speed Limit: N/A
Length: 0.8 Mile
Vehicle Lanes: N/A
Parking: N/A

This proposed route would be the continuation of the existing Bayshore Bikeway and would be a direct connection to Rainbow Drive. This route allows users to bypass the Seventh Street access and a more direct route to the Ecoroute via Rainbow Drive to Palm Avenue and less time on City streets. Due to the potential impact of adjacent wetlands, an EIR may need to be developed to determine environmental impacts and feasibility.

7.1.25 Rainbow Drive

Segment: State Route 75 to Palm Avenue
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 2 Bike Lane
ADT: 800 - 5,000
Speed Limit: 35 MPH
Length: 827 Feet
Vehicle Lanes: 2
Parking: On-street parallel

This short segment connects the proposed Class 1 bike paths to Palm Avenue. Adjacent land use is commercial on the east side and residential on the west side. Due to the low ADTs and adjacent land use, a Class 2 bike lane is recommended to connect Palm Avenue and the Class 1 bike path.

7.1.26 Third Avenue (West View Elementary School)

Segment: Third Street between West View Elementary and Palm Avenue
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: <800
Speed Limit: 25 MPH
Length: .22 Miles
Vehicle Lanes: 2
Parking: On-street parallel

This short segment connecting the adjacent neighborhoods and Palm Avenue with West View Elementary School.

7.1.27 Oneonta Elementary School route

Segment: Fern Avenue, 11th Street, Essex Street, Grove Avenue and 10th Street
Programmed Bicycle Facility: None
Recommended Bicycle Facility: Class 3 Bike Route
ADT: 800 - 1,000
Speed Limit: 25 MPH
Length: .72 Miles
Vehicle Lanes: 2
Parking: On-street parallel

This route connects the adjacent neighborhoods with Oneonta Elementary School. This route connects to recommended routes on Imperial Beach Boulevard, Ninth Street and Holly Avenue.

7.2 Other Segments Analyzed

7.2.1 Tenth Street

Segment: Between Palm Avenue and Imperial Beach Boulevard
Programmed Bicycle Facility: None
Recommended Bicycle Facility: None
ADT: <800
Speed Limit: 25 MPH
Length: 0.5 Miles
Vehicle Lanes: 2
Parking: On-street parallel

View north from Palm Avenue. Tenth Street does not travel through the Palm Avenue intersection.

Tenth Street was proposed at the community meeting, followed by field review. This street is a low volume north-south connection, but it does not connect across Palm Avenue or Imperial Beach Boulevard because medians within these roadways limit connectivity. Ninth Street and Florida Avenue are only a few blocks away and do cross these two arterials. At the intersections of Tenth Street and Elder and Elm Avenues, there are stop signs on Tenth Street and none on the cross streets. These are the same safety issues that face Florida Avenue. Florida Avenue is a more central bicycle facility between Ninth and Thirteenth Streets and crosses Palm Avenue to access the Bayshore Bikeway. For these reasons, Tenth Street was not chosen as a bicycle facility.

7.2.2 Alleys

It was suggested at the community meeting that the City of Imperial Beach many alleys could be designated as bicycle facilities, so additional field work was performed to address this suggestion.

It was found that surfaces vary from alley to alley, but the majority are paved. However, many are either hard packed dirt or gravel, and there is occasionally debris and vegetation narrowing the pathway.

Using the alleys could pose some safety issues for cyclists. Because of the grid street network, there are many mid-block crossings where the alleys intersect the streets. Fences sometimes extend out to the sidewalk and block cyclist and pedestrian line-of-sight to the crossing street. If cyclists and pedestrians were to use alleys, they would be out of sight from passersby and if help was needed, they might not be seen and quickly attended to.

There would also need to be traffic calming measures and signage on all streets in which they intersect. Potentially, traffic signals may need to be installed at high volume intersections.

In addition, there is some question whether alleys can be regarded as legal roadways. Finally, if bicycle facilities were installed on alleys, the City would need to maintain them to street maintenance standards.

7.3 Intersection Recommendations

7.3.1 Palm Avenue at Ninth Street and Thirteenth Street

The intersections of Ninth Street, Thirteenth Street on Palm Avenue are heavily used and currently incorporate crosswalk signals in all directions. Cyclists using these intersections rarely have to activate the crosswalk signals because there are usually motor vehicles on all directions to activate the signals.

In older communities such as the City of Imperial Beach, a regular street grid pattern can provide a variety of alternative routes for both cyclists and motorists. Even so, the contrast between traffic on residential streets and that found on arterials is significant, though crossings may be less difficult than in other cities with a more suburban layout. Palm Avenue has three lanes in each direction with parking on both sides. In these situations, cyclists can edge out near the intersection to see beyond the parked cars. As a result, crossing the street is reduced by about 16 feet (eight foot parking stalls on both sides).

From workshop attendees, it was noted that these intersections are not very pedestrian friendly. Recommendations include crosswalks and signals that allow more crossing time. This would also be helpful for cyclists so they have a more time to get across, especially with children. Thirteenth Street would benefit from longer signal phases and a crosswalk since the Bayshore Bikeway currently ends at Thirteenth Street. This can attract users to come into the City and utilize local restaurants and amenities.

Thirteenth Street view north from Palm Avenue

Palm Avenue view east from 7th Street

7.3.2 Seventh Street and Palm

The Seventh Street crossing of SR-75 and Palm Avenue could be considerably improved for cyclists with appropriate signage, particularly in the southbound direction. The apparent complexity of the intersection and crossing length may make it difficult for first time cyclists to readily negotiate. Besides freestanding signage, banners and symbols painted on the roadway surface, a modified traffic signal interval may be desirable.

Since the short segment of Seventh Street north of Palm Avenue and south of SR-75 widens to 46 feet, a short Class 2 bike lane segment could be striped here with appropriate pavement markings, incorporating the Ecoroute Bikeway symbol, to help direct cyclists across the intersection.

During the workshop, tunnels were mentioned as an option to route cyclists below the Palm Avenue and SR-75 intersection. Although this would be a safer crossing, the flat terrain would require raising the roadway surface with considerable ramping to meet the needed height. The cost and construction would not be practical unless the bicycle route was much more extensively used, and even

Bayshore Bikeway at 8th Street

Bayshore Bikeway at 7th Street

Bayshore Bikeway at 13th Street

Bayshore Bikeway at 10th Street. Programmed to be an access to the Bayshore Bikeway

then, a bridge may be more feasible, due to a likely high water table in the area.

7.3.3 Bayshore Bikeway at Seventh and Thirteenth Streets

The handling of this intersection is critically important to draw cyclists into Imperial Beach who are accustomed to staying on the Bayshore Bikeway. Future completion of the Bikeway will certainly draw more users and many will be looking for longer routes or side trips to add to their usual route.

Signage highlighting Imperial Beach's attractions as stops along the proposed Ecoroute Bikeway within the City is recommended. These attractions include the Imperial Beach beaches, beach front parks and pier, the Tijuana River Estuary, and the dunes access at the south end of Seacoast Drive.

The signage should clearly indicate this is a scenic loop route to make certain cyclists know they can easily return to the Bayshore Bikeway at this point to continue on their way and the relative distances to each attraction. Dining and restroom facilities should be noted as well.

During field investigations, significant numbers of cyclists were seen using the Thirteenth Street trail head parking area to access the Bayshore Bikeway. As many as eight vehicles were seen there on a Thursday afternoon in March. This is another potential restroom location where there is also available public land.

Providing some parking may be desirable once the Bayshore Bikeway is completed and its use increases. At that time, the Seventh Street terminus may become the preferred trail head since it is located at the junction of the Bayshore Bikeway and the proposed Ecoroute Bikeway.

7.3.4 Bayshore Bikeway at Tenth Street

The Tenth Street access onto the Bayshore Bikeway is programmed to open in the near future. As with the other points of entry, signage, restrooms and bicycle parking should be investigated as amenities for this entry. This entrance to the City is a recommended since it allows children from the adjacent Bayside Elementary School a safer bicycle route to and from school.

During field work and workshop comments, it was noted that for cyclists on the Bayshore Bikeway, restrooms are far apart. There are no public restrooms along the route itself, and along the route most cyclists currently use, the nearest public restrooms are at the Coronado Ferry Landing. Workshop attendees indicated that a rest stop with interesting informational signage, seating and shade, and ideally one with restroom facilities, would be a welcome addition at the Tenth Street connection to the Bayshore Bikeway. Bikeway users have said that such a rest stop

would prompt them to stop and consider a side trip into Imperial Beach and that the extra distance was not a detriment and could even be considered an enhancement to their usual riding route. This makes this site a potentially excellent tie-in opportunity with the proposed Ecoroute Bikeway.

Because the entrance is adjacent to the Public Works building with nearby maintenance opportunities, restroom facilities are recommended at this location. The adjacency to a City facility will allow regular maintenance and security. It is also centrally located between the Seventh and Thirteenth Street entrances to the Bayshore Bikeway.

Bayshore Bikeway at 12th Street. Missing curb cuts to allow a safe access on to the bike path.

7.3.5 Bayshore Bikeway at Twelfth Street

In addition to the Seventh and Thirteenth Street entrances to the City from the Bayshore Bikeway, users can enter the City from Eighth Street and Twelfth Street as well. Twelfth Street is predominantly a pedestrian entrance since it is connected by narrow pavement from the curb to the bikeway. However, the Twelfth Street access does not have any curb cuts to allow a smooth rolling transition from the street to the bikeway. Most recreational cyclists and children would have to dismount, lift their bikes onto the curb and continue. Cyclists and children unfamiliar with the access might exit the bike path too quickly and not realize that they must “hop” a curb to access the street. The closest curb cut is a driveway entrance to a private residence about 50 feet away from the access path. A curb cut such as on 8th Street is recommended to provide a safer and more convenient access to the bike path from Twelfth Street.

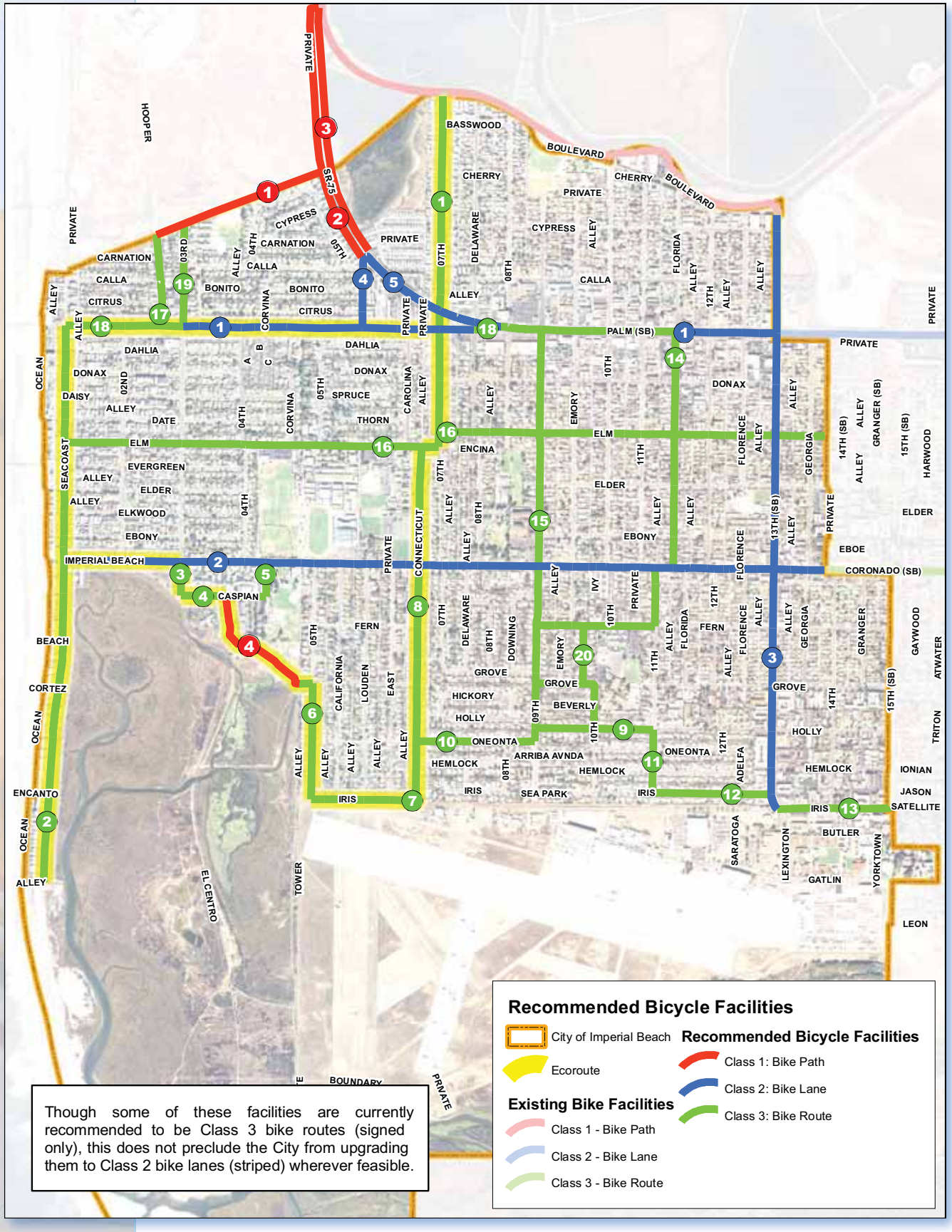
7.4 Bicycle Parking

For a bikeway network to be used to its full potential, secure bicycle parking should be provided at likely destination points. Bicycle thefts are common and lack of secure parking is often cited as a reason people hesitate to ride a bicycle to certain destinations. The same consideration should be given to bicyclists as to motorists, who expect convenient and secure parking at their destinations.

Bicycles parked in the dugout at the Sports Park

Currently bicycle racks can be found at most major destination points such as the Tijuana Estuary Visitors Center, Dunes Park, Pier Park, Sports Park and the public library. During field investigations, only one bike rack was seen being used and people tended to park their bicycles closer to where they were stopped so they could keep their bikes in sight, which were rarely locked. In some cases, bicycles were left unattended leaning on rails, fences and buildings. For situations such as the Sports Park where there are numerous places to lock a bike other than a bike rack, the current bike rack would be sufficient to handle many bikes. Children tended to lean their bikes along the chain link fence of the field they were playing on. An example of a poorly designed bike rack is at the public library on Imperial Beach Boulevard. The four-sided design can realistically accommodate only two bikes which will end up taking up a good portion of the library entrance way.

Figure 7.1 Recommended Bicycle Facilities



The Tijuana Estuary Visitors Center has an antiquated type of bike rack that is not even secured to the ground. Since the Visitors Center is a major destination, bike lockers would work well here. In a place like the Tijuana Estuary where visitors can spend hours hiking the trails, leaving their bicycles secured in lockers could increase bicycle use to the Visitors Center which could reduce vehicular traffic and potential parking problems. Visitors will be more comfortable knowing their bikes are secure for a longer period of time. A bike rack is also recommended at Veterans Park since it currently lacks bike parking.

Bicycle rack at the public library

Bicycle racks must be designed so that they:
- Do not bend wheels or damage other bicycle parts;
- Accommodate the high security U-shaped bike locks;
- Accommodate locks securing the frame and both wheels;
- Do not trip pedestrians;
- Are covered where users will leave their bikes for a long time; and
- Are easily accessed from the street and protected from motor vehicles.

To provide real security for the bicycle (with its easily removed components) and accessories (lights, pump, tools and bags), either bicycle enclosures, lockers or a check-in service is required. Bicycle parking facilities are generally grouped into two classes:

Long Term - Provides complete security and protection from weather; it is intended for situations where the bicycle is left unattended for long periods of time: apartments and condominium complexes, schools, places of employment and transit stops. These are usually lockers, cages or rooms in buildings.

Short Term - Provides a means of locking bicycle frame and both wheels, but does not provide accessory and component security or weather protection unless covered. It is for decentralized parking where the bicycle is left for a short period of time and is visible and convenient to the building entrance.

Bicycle rack at the corner of Seacoast Drive and Imperial Beach Boulevard

8 CIPs and Bikeway Funding

The following sections define the recommended bikeway system improvements as CIP projects and provide construction costs. See Figure 8-1: Recommended Bikeway Facility Segments, for a graphic overview of the proposed bikeway segments. For general bikeway component construction costs, see Table 8-1: Typical Unit Construction Costs. For a brief description of each segment, including estimated costs and segment lengths, see Table 8-2: Capital Improvement Projects. The remaining sections of this chapter describe the funding sources available for bikeway projects, followed by a summary, Table 8-3: Bikeway Facility Funding Summary.

8.1 Bikeway Development Priorities

The numbering used to identify projects within each bikeway facility class in the following sections does not necessarily imply priority. Bikeway facility implementation has no specific time line, since the availability of funds for implementation is variable and tied to the priority of the City's capital projects. (See Section 8.2: Facility Priority Criteria and Implementation.)

Note that the segment numbering sequence lists the Class 1 SR-75 bike path alternatives first, along with separate lists of proposed Class 2 facilities and the Class 3 facilities. This represents the recommended prioritization within facility classes only. It is difficult to prioritize all of the proposed bikeway facilities across the facility classes because several Class 3 routes could be implemented for far less than the cost of a single Class 2 lane, for example. Therefore, it is recommended that the Class 1, 2 and 3 facilities be regarded as parallel lists and be implemented as appropriate funds become available for each type of facility. (See Table 8-2: Capital Improvement Projects, for more information.) Additionally, facility prioritization criteria identified in Section 8.2 can be used to help identify which bikeways are likely to provide the most benefit to the bikeway system user type expected.

8.2 Facility Priority Criteria and Implementation

The following prioritization criteria can be used to help identify which routes are likely to provide the most benefit to the City bikeway system:

Mobility and Access (total of 20 points)

1. Volume of existing or potential bicycle traffic: 0 – 10 points
2. Provides access to major bicycle traffic generators: 0 – 5 points
3. Closes gap in significant route: 0 – 5 points

Safety (total of 15 points)

4. Remedies or improves specific obstacles: 0 – 5 points
5. Improves locations where bicycle crashes have occurred: 0 – 5 points
6. Improves routes with high vehicular traffic volumes: 0 – 5 points

Ability to Implement (total of 10 points)

7. Route or project has full or partial funding, or is likely to be funded: 0 – 5 points
6. Route or project is contained in a specific plan: 0 – 5 points

The maximum possible score is 45 points. Proposed projects can be rated periodically at whatever interval best fits funding cycles or to take into consideration the availability of new information, new funding sources, updated crash statistics, etc. Bikeway facility prioritization and implementation should be fine-tuned and adjusted accordingly based on future circumstances.

The cost of each project will always be a consideration. For example, if two projects with a high cost differential score within five points of each other based on the priority criteria, the lower cost project can be placed ahead of the higher cost project.

Table 8.1 Typical Construction Costs

Description	Unit	Unit Cost
Asphalt Pavement (4")	Square Foot	$1.20-$1.50
Bike Lane Striping	Linear Foot	$0.60-$0.80
Pavement Markings	Each	$40.00-$50.00
Fencing (Chain link)	Linear Foot	$16.00-$20.00
Guardrail	Linear Foot	$20.00-$25.00
8' Steel or Concrete Bridge	Linear Foot	$1,200-$1,500
36" Retaining Wall (Concrete	Square Foot	$32.00-$40.00
Relocate Signs/Fencing	Linear Foot	$1.00-$2.00
Drainage	Linear Foot	$1.00-$5.00
Traffic/Bike Path Signing	Linear Foot	$2.40-$3.00
Lighting	Each	$500.00
Traffic Control	Linear Foot	$0.20-$0.40
Clean Up	Linear Foot	$0.10-$0.20

Add 20% for contingencies, 10% for engineering and design, 5% for administration and 7% for construction management.

8.3 Typical Unit Construction Costs

Bikeway facility construction costs vary widely depending on facility type. A list of typical unit construction costs in 2005 dollars are shown in Table 8-1. Though useful for preliminary cost estimates, they do not reflect potential special circumstances such as the long bridges that would be needed to span rail lines or freeways, for instance. The following sections provide generalized costs per mile for each class of bicycle facility, as well as what these costs cover, and just as importantly, what they do not. Because typical cost references often do not accurately reflect local construction cost realities, these cost estimates were based on comparisons of bikeway facility projects recently completed in the San Diego metropolitan region.

8.3.1 Class 1 Bikeways

Because they are constructed independently of existing or programmed motor vehicle facilities, Class 1 paths are by far the most expensive of all bicycle facilities. Typical costs per mile can vary a great deal due to possible right-of-way acquisition, bridges and other potential major expenses such as extensive grading. The cost range is primarily due to topography and facility width. For example, a Class 1 facility on flat terrain will require far less grubbing, grading and structural enhancements than a facility being constructed through an undeveloped area with hilly topography. For this bikeway master plan, the cost used in Table 8-2 for the class 1 segment was $466 per linear foot, or approximately $2,460,480 per mile, due to potentially extensive construction, grading, bridges and environmental review. A more standardized figure was used for the other Class 1 segments of $190 per linear foot, or $1,000,000 per mile.

8.3.2 Class 2 Bikeways

Class 2 facility costs are approximately $15,000 to $35,000 per mile. This cost includes necessary lane striping and signage, but does not include widening of roadways. The cost variation is due to the amount of striping and signage installed. For example, the cost will be higher where substantial re-striping is needed, or right-of-way acquisition. The cost used in Table 8-2 was $6 per linear foot, or approximately $32,000 per mile.

8.3.3 Class 3 Bikeways

Class 3 routes costs are the lowest of all facility types because the only physical improvement to be installed is route signage. The cost range of $1,500 to $5,000 per mile is due to the distance between signs, which can vary considerably depending upon factors such as horizontal and vertical curvature, the number the intersections and curb cuts, and how often the route changes direction onto different roadways. The cost used in Table 8-2 was $0.70 per linear foot, or approximately $3,500 per mile.

Table 8.2 Capital Improvement Projects

Class 1 Bicycle Facilities

Segment Numbers	Length (Ft)	Length (Miles)	Description	Est Costs	Notes
1	3,960	**0.75**	Bike path on southbound SR-75 to Silver Strand Blvd	$1,845,360	Alternative #1 allows access onto the western side of the City without have to cross Palm Ave
2	3,010	**0.57**	Bike path on southbound SR-75 to Rainbow Drive	$1,402,474	Alternative #2 allows bike path access to Rainbow Drive if Alternative #1 is not feasible
3	2,798	**0.53**	Bike path on northbound SR-75 to Rainbow Dr	$1,304,054	Alternative #3 is a continuation of existing Bayshore Bikeway and direct connection to Rainbow Dr
4	1,584	**0.30**	Bike path between Caspian Way to Grove Ave	$738,144	Bike path through the Tijuana Estuary and part of the Ecoroute
Totals	**11,352**	**2.15**		**$5,290,032**	

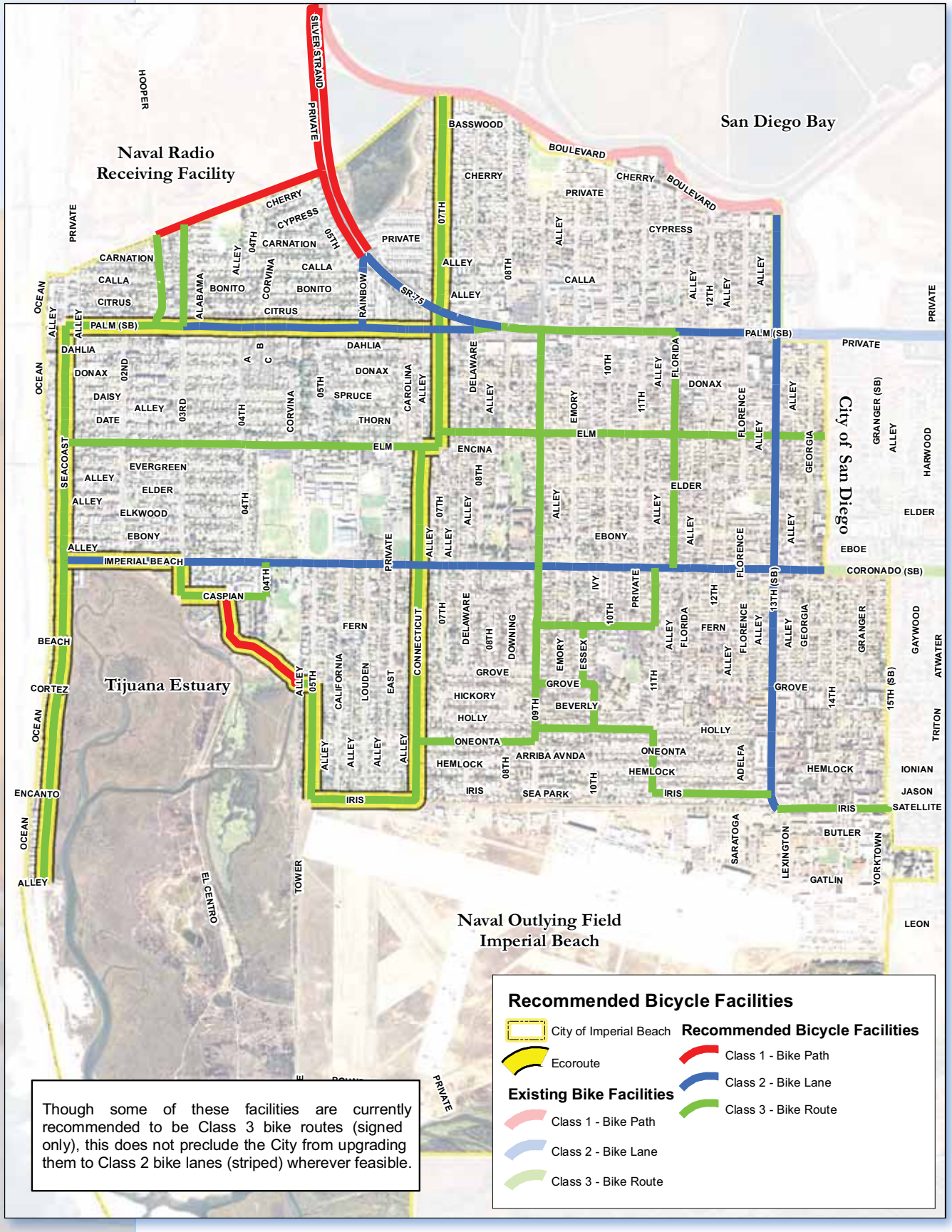
Class 2 Bicycle Facilities

Segment Numbers	Length (Ft)	Length (Miles)	Description	Est Costs	Notes
1	4,212	**0.80**	Palm Ave between 3rd St and Delaware St and between Florida St and the City limit.	$25,526	Continuation of the bike lane that enters the City from Thirteenth St to the coast
2	10,560	**2.00**	Imperial Beach Blvd between Seacoast Dr to City of San Diego limit	$64,000	Alternative #1 for this segment as programmed
3	6,864	**1.30**	Thirteenth St between Bayshore Bikeway to Iris Ave	$41,600	Programmed Class 2 bike lanes
4	827	**0.16**	Rainbow Drive between SR-75 and Palm Ave	$548	Access to Palm Ave without the heavy traffic and high speeds of SR-75 and connects to alternative bike lanes
5	1,753	**0.33**	Palm Avenue/SR-75 between Rainbow Drive and Delaware Street	$1,162	Recommended bike lanes to transition the bike routes on Palm Ave to the planned bike paths along SR-75
Totals	**24,216**	**4.59**		**$131,674**	

Class 3 Bicycle Facilities

Segment Numbers	Length (Ft)	Length (Miles)	Description	Est Costs	Notes
1	4,224	**0.80**	Seventh Street between Bayshore Bikeway and Elm Ave	$2,800	Primary access point to the Bayshore Bikeway and beginning of the programmed Ecoroute
2	6,336	**1.20**	Seacoast Drive from Palm Ave to its terminus	$4,200	Class3 bike route with shared bike lane markings and part of the Ecoroute
3	388	**0.07**	Third St between Imperial Beach Blvd and Caspian Way	$257	Ecoroute segment
4	1,056	**0.20**	Caspian Way between Third St and Fourth St	$700	Ecoroute segment
5	388	**0.07**	Fourth St between Caspian Way and Imperial Beach Blvd	$257	Connects Ecoroute and Tijuana Estuary Visitors Center with the Sports Park
6	1,584	**0.30**	Fifth St between Grove Avenue and Iris Ave	$1,050	Continuation of Ecoroute from Tijuana Estuary
7	1,056	**0.20**	Iris Ave between Fifth St and Connecticut St	$700	Ecoroute segment
8	4,752	**0.90**	Connecticut St between Iris Ave to Elm Ave	$3,150	Ecoroute segment
9	1,584	**0.30**	Oneonta Ave between Connecticut St and Ninth St	$1,050	Ecoroute connection between Connecticut St and Ninth St
10	1,584	**0.30**	Holly Ave between Ninth St and Eleventh St	$1,050	Segment to connect transit routes and southern most east-west route
11	528	**0.10**	Eleventh St between Holly Ave and Iris Ave	$350	High number of bicycle commuters along this segment
12	1,584	**0.30**	Iris Ave between Eleventh St and Thirteenth St	$1,050	Connect with Thirteenth St and Imperial Beach NOLF
13	1,056	**0.20**	Iris Ave between Thirteenth St and City limit	$700	Connects Thirteenth St and City of San Diego
14	2,640	**0.50**	Florida St between Palm Ave and Imperial Beach Blvd	$1,750	North-south connection in which intersection issues must be addressed
15	4,752	**0.90**	Ninth St between Palm Ave and Holly Ave	$3,150	Central north-south connection between Palm Ave and Holly Ave
16	7,392	**1.40**	Elm Ave between Seacost Dr and City of San Diego limit	$4,900	Central east-west connection with low traffic volumes
17	1,045	**0.20**	Silver Strand Boulevard between NRRF Base entrance and Palm Avenue	$693	Bike route to connect base entrance with Palm Ave
18	3,602	**0.68**	Palm Avenue between Seacoast Drive and 3rd Street and between Delaware Street and Florida Street	$2,388	Bike routes to complete a bicycle facility throughout Palm Ave
19	1,151	**0.22**	Third Street between Palm Ave and West View Elementary	$763	Bike route to connect the adjacent neighborhoods and Palm Ave to West View Elementary
20	3,813	**0.72**	Fern Ave, 11th St, Essex St, Grove Ave and 10th St	$2,528	Bike routes to complete a bicycle facility to Oneonta Elementary School
Totals	**50,515**	**9.57**		**$33,485**	

Figure 7.1 Recommended Bicycle Facilities



8.3.4 Bikeway Bridge Improvements

The following information concerns bridges designed to serve bicycle facilities in locations other than planned or programmed roadway bridges. Typical roadway bridges are constructed of reinforced concrete to withstand the enormous stresses of motor vehicle traffic and seismic activity. Bridges intended for non-motorized uses do not need to be as robust or as costly as bridges designed for regular motor vehicle use.

Bridges costs depend on design load and foundation, and to a lesser extent, length, width and materials. Bridges must be designed to carry the same loads as the bikeway facility they serve. On Class 1 facilities, for example, where patrol, emergency or maintenance vehicles are expected to use the bridge, it must be able to support at least the gross weight of the heaviest anticipated vehicle. Bridges intended to support motor vehicles will require much sturdier construction and increased width, both of which will increase costs.

Unstable soil conditions will require any bridge to be built with more expensive foundations in the form of larger footings or piers. Wooden bridges tend to be less expensive than metal bridges, though their useful life may be shorter. Bridge costs increase almost exponentially as their height increases due to increased structural complexity. Finally, prefabricated bridges are generally cheaper and less environmentally damaging to install than constructed-in-place bridges. For bridge preliminary cost estimates, $1,500 to $1,750 per linear foot is adequate.

8.4 Bikeway Funding Sources

Federal, State and local government agencies invest billions of dollars every year in the nation's transportation system. Only a fraction of that funding is used in development projects, policy development and planning to improve conditions for cyclists. Even though appropriate funds are limited, they are available, but desirable projects sometimes go unfunded because communities may be unaware of a fund's existence, or may apply for the wrong type of grants. Also, the competition between municipalities for the available bikeway funding is often fierce.

Whenever Federal funds are used for bicycle projects, a certain level of State and/or local matching funding is generally required. State funds are often available to local governments on the similar terms. Almost every implemented bicycle program and facility in the United States has had more than one funding source and it often takes a good deal of coordination and opportunism to pull the various sources together.

According to the FHWA's publication, An Analysis of Current Funding Mechanisms for Bicycle and Pedestrian Programs at the Federal, State and Local Levels, where successful local bike facility programs exist, there is usually a full-time bicycle coordinator with extensive understanding of funding sources. Cities such as Seattle, Washington, Portland, Oregon and San Diego are prime examples. Bicycle coordinators are often in a position to develop a competitive project and detailed proposal that can be used to improve conditions for cyclists within their jurisdictions. Much of the following information on Federal and State funding sources was derived from the previously mentioned FHWA publication.

8.4.1 Federal Sources

U.S. Department of Transportation TEA-21 (Transportation Equity Act) Enhancement Funds

In 1991, Congress re-authorized the collection and distribution of the Federal gasoline tax and related transportation spending programs. The legislation, the Intermodal Surface Transportation Enhancement Act (ISTEA), was seen as particularly significant because the focus of 30 years of Federal transportation investment, the Interstate Highway System, was nearing completion. The legislation provided the opportunity to rethink transportation priorities and philosophies. This act was re-authorized in 1997 as the Transportation Equity Act (TEA-21), and again in 2005.

TEA-21 funding is currently managed through State and regional agencies, in this case the San Diego Association of Governments (SANDAG). Most, but not all, of the funding programs are oriented toward transportation versus recreation, with the emphasis on reducing auto trips and providing intermodal connections. Funding criteria include completion and adoption of a bicycle master plan, quantification of the costs and benefits of the system (including saved vehicle trips, reduced air pollution), proof of public involvement and support, NEPA compliance and the commitment of local resources. In most cases, TEA-21 provides matching grants of 80 to 90 percent. The amount of money available through TEA-21 is substantial (over $155 billion from 1992-97), but there is always strong competition to obtain those funds.

Federal funding through the TEA-21 program provides the bulk of outside funding. TEA-21 is comprised of two major programs, Surface Transportation Program (STP) and Congestion Management and Air Quality Improvement (CMAQ), along with other programs such as the National Recreational Trails Fund, Section 402 (Safety) funds, Scenic Byways funds and Federal Lands Highways funds, though municipalities are unlikely to be eligible for funding from all of these sources. Among the new concepts in the original legislation were intermodalism, transportation efficiency, funding flexibility and planning, all of which had direct benefits for cycling. The legislation also created a wide range of funding opportunities for bicycle-related activities, including the following that may represent opportunities for the City of Imperial Beach:

Surface Transportation Program (STP)

Section 1007 (a)(I)(b)(3) allows states to spend their allocation of Surface Transportation Program funds on a range of activities similar to those of the NHS. Bicycle facilities are specifically listed as eligible items. STP Funds can also be used for "non-construction bicycle projects related to safe bicycle use." Section 1007 (b)(2)(C)(c) created a new category of transportation enhancement activities (TEA) on which States were required to spend at least 10 percent of their Surface Transportation Program funds. TEAs are very broadly defined as:

> "...with respect to any project or the area to be served by the project, provision of facilities for pedestrians and cyclists, acquisition of scenic easements and scenic or historic sites, scenic or historic highway programs, landscaping and other scenic beautification, historic preservation, rehabilitation and operation of historic transportation buildings, structures or facilities including historic railroad facilities and canals, preservation of abandoned railway corridors (including the conversion and use thereof for pedestrian and bicycle trails), control and removal of outdoor advertising, archaeological planning and research and mitigation of water pollution due to highway runoff."

Surface Transportation Program funds are allocated to the California Department of Transportation (Caltrans) and 75 percent of STP funds are programmed by regional agencies such as the San Diego Association of Governments (SANDAG) under current state law. The Federal government does not allocate funds to specific projects. Therefore, for a bicycle project to be funded, it must appear on the list of potential projects under consideration at the State, regional, or City level, whichever is appropriate.

Local Planning

Section 1024 (a) requires each metropolitan area (with a population greater than 200,000) to develop an annual or biannual Transportation Improvement Program (TIP) that "shall provide for the development of transportation facilities (including pedestrian walkways and bicycle transportation facilities) which will function as an intermodal transportation system."

These TIPs must be based on available funding for projects in the program and they must be coordinated with transportation control measures to be implemented in accordance with Clean Air Act provisions. Final project selection rests with the California Transportation Commission (CTC), with technical input from Caltrans.

State Planning

Two sections of the Act explicitly require the State to develop a TIP to "consider strategies for incorporating bicycle transportation facilities and pedestrian walkways in projects, throughout the State," (Section 1025 (c)(3)), and to "develop a long-range plan for bicycle transportation facilities and pedestrian walkways for appropriate areas of the State, which shall be incorporated into the long-range transportation plan," (Section 1025 (e)). These provisions are important on a municipal level because they are crucial for getting incidental bicycle projects funded. The intent behind these sections is to ensure that if bicycle facilities are identified in a TIP or long-range plan as being necessary in a corridor and construction or reconstruction work in those corridors is planned, then the relevant bicycle improvements called for in the planning must be included and implemented. Opportunities for incorporating bicycle projects are not limited to large transportation projects and not even to actual construction projects. Independent bicycle and pedestrian projects, such as trails away from highway corridors and non-construction projects, such as mapping, also need to be incorporated into State and City planning documents if they are to be funded.

Section 1033 states that the Federal share under TEA-21 of bicycle transportation facilities is to be 80 percent. The remaining 20 percent of the funds must be matched by the State or local government agency implementing the project. The section also states that, to be funded, a bicycle transportation facility must be principally for transportation rather than recreation purposes. This has been defined by the FHWA to mean:

"Where Federal-aid highway funds are used, these projects should serve a transportation function. A circular recreation path, for example, would not be eligible. However, any type of facility which does serve a valid transportation need while also fulfilling recreation purposes would be eligible." The section goes on to describe a "bicycle transportation facility" as: "new or improved lanes, paths or shoulders for the use of cyclists, traffic control devices, shelters and parking facilities for cyclists."

Congestion Mitigation and Air Quality Program (CMAQ)

Section 1008 is referred to as the Congestion Mitigation and Air Quality Program (CMAQ). This part of the legislation is intended to fund programs and projects likely to contribute to the attainment of national ambient air quality standards under the 1990 Clean Air Act Amendments. Five areas of eligibility have been defined: Transportation activities in an approved State Implementation Plan (SIP) developed under the Clean Air Act Transportation Control Measures listed in Section 108 (b)(1)(A) of the Clean Air Act, which include:

(ix) Programs to limit portions of roadway surfaces or certain sections of the metropolitan area to the use of non-motorized vehicles or pedestrian use, both as to time and place;

(x) Programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of cyclists in both public and private areas; and

(xv) Programs for new construction and major reconstruction of paths, tracks, or areas solely for the use by pedestrians or other non-motorized means of transportation, when economically feasible and in the public interest."

"Construction of bicycle and pedestrian facilities, non-construction projects related to safe bicycle use and State bicycle/pedestrian coordinator positions as established in the TEA- 21, for promoting and facilitating the increased use of non-motorized modes of transportation. This includes public education, promotional and safety programs for using such facilities."

To be funded under this program, projects and programs must come from a transportation plan (or State (STIP) or Regional (RTIP) Transportation Improvement Program) that conforms to the SIP and must be consistent with the conformity provisions of Section 176 of the Clean Air Act.

Section 402 (Safety) Funds

Section 402 funds address State and community highway safety grant programs. The priority status of safety programs for cyclists expedites the approval process for these safety efforts.

Symms National Recreational Trails Act

The Symms National Recreational Trails Act created a trust fund for the construction and maintenance of trails. At least 30 percent of the funds must be spent on trails for non-motorized users and at least 30 percent for trails for motorized users. The remainder is to be allocated to projects as determined by the State Recreational Trails Advisory Board of the California Department of Parks and Recreation, which the State must have to be eligible for the funds.

Federal Transit Act

Section 25 of the 1964 Urban Mass Transportation Act states that: "For the purposes of this Act a project to provide access for bicycles to mass transportation facilities, to provide shelters and parking facilities for bicycles in and around mass transportation facilities, or to install racks or other equipment for transporting bicycles on mass transportation vehicles shall be deemed to be a construction project eligible for assistance under sections 3, 9 and 18 of this Act." The Federal share for such projects is 90 percent and the remaining 10 percent must come from sources other than Federal funds or fare box revenues. Typical funded projects have included bike lockers at transit stations and bike parking near major bus stops. To date, no projects to provide bikeways for quicker, safer or easier access to transit stations have been requested or funded.

Department of the Interior - Land and Water Conservation Fund (LWCF)

The U.S. Recreation and Heritage Conservation Service and the State Department of Park and Recreation administer this funding source. Any project for which LWCF funds are desired must meet two specific criteria. The first is that projects acquired or developed under the program must be primarily for recreational use and not transportation purposes and the second is that the lead agency must guarantee to maintain the facility in perpetuity for public recreation. The application will be considered using criteria such as priority status within the State Comprehensive Outdoor Recreation Plan (SCORP). State Department of Park and Recreation will select which projects to submit to the National Park Service (NPS) for approval. Final approval is based on the amount of funds available that year, which is determined by a population-based formula. Trails are the most commonly approved project.

National Recreational Trail Fund

This funding source is intended to pay for a variety of recreational trails programs to benefit cyclists, pedestrians and other non-motorized users. Projects must be consistent with the State Comprehensive Outdoor Recreation Plan required by the Land and Water Conservation Act.

8.4.2 State Sources

Streets and Highways Code – Bicycle Transportation Account (BTA)

The Bicycle Transportation Account (BTA) funds non-motorized facilities and access to cities and counties that have adopted bikeway master plans. Section 2106 (b) of the Streets and Highways Code transfers funds annually to the BTA from the revenue derived from the excise tax on motor vehicle fuel. The Caltrans Office of Bicycle Facilities administers the BTA. It is locally administered through SANDAG to counties and cities. Approximately $8.2 million is available annually to projects in San Diego County. For a project to be funded from the BTA, the project shall:

i) Be approximately parallel to a State, county, or city roadways, where the separation of bicycle traffic from motor vehicle traffic will increase the traffic capacity of the roadway; and

ii) Serve the functional needs of commuting cyclists; and

iii) Include but not be limited to:

- New bikeways serving major transportation corridors;
- New bikeways removing travel barriers to potential bicycle commuters;
- Secure bicycle parking at employment centers, park and ride lots and transit terminals;
- Bicycle-carrying facilities on public transit vehicles;
- Installation of traffic control devices to improve the safety and efficiency of bicycle travel;
- Elimination of hazardous conditions on existing bikeways serving a utility purpose;
- Planning; and
- Safety and education

Maintenance is specifically excluded from funding and allocation takes into consideration the relative cost effectiveness of the proposed project.

State Highway Account

Section 157.4 of the Streets and Highways Code requires Caltrans to set aside $360,000 for the construction of non-motorized facilities that will be used in conjunction with the State highway system. The Office of Bicycle Facilities also administers the State Highway Account fund. Funding is divided into different project categories. Minor B projects (less than $42,000) are funded by a lump-sum allocation by the CTC and are used at the discretion of each Caltrans District office. Minor A projects (estimated to cost between $42,000 and $300,000) must be approved by the CTC. Major projects (more than $300,000) must be included in the State Transportation Improvement Program and approved by the CTC. Funded projects have included fencing and bicycle warning signs related to rail corridors.

Transportation Development Act Article III (Senate Bill 821)

Transportation Development Act Article III funds are State block grants awarded annually to local jurisdictions for bicycle and pedestrian projects in California. The funds originate from the State retail sales tax and are distributed through the Congestion Management Agency to local jurisdictions based generally of population. Examples of expenditures have included construction of bicycle facilities and printing of bicycle safety posters on the back of city buses.

8.4.3 Other State Bicycle Project Funding Sources

Governor's Energy Office (Oil Overcharge Funds)

The Federal government forced oil companies to repay the excess profits many of them made when they violated price regulations enacted in response to the energy crisis of the early 1970's. Few states have taken advantage of this fund, but some have received grants for bike coordinators and bicycle facilities. The types of projects eligible for funding vary by state, as does the level of allocation available.

Safe Routes to School Program (SR2S)

The Safe Routes to School Program funds non-motorized facilities in conjunction with improving access to schools through the Caltrans Local Assistance Division.

8.4.4 Local Sources

TransNet Sales Tax Funds

San Diego County voters passed a local tax ordinance authorizing the creation of the TransNet Sales Tax, imposing a 1/2 cent "transaction and use tax" solely to fund transportation improvements. About one million dollars are allocated annually for improved bicycle routes throughout the region. The ordinance describes bicycle facilities and requirements for facilities as:

"All purposes necessary and convenient to the design, right-of-way acquisition and construction of facilities intended for the use of bicycles. Bicycle facilities shall also mean facilities and programs that help to encourage the use of bicycles, such as secure bicycle parking facilities, bicycle promotion programs and bicycle safety education programs."

"All new highway projects funded with revenues as provided in this measure, which are also identified as bikeway facilities in the Regional Transportation Plan (RTP), shall be required to include provision for bicycle use."

Proposition A

This is a funding source administered by SANDAG with an annual availability of approximately $1 million per year.

Assembly Bill 2766/434

This bill funds air pollution reduction projects related to alternate modes of transportation. The Air Pollution Control Board (APCB) administers this fund. Approximately $3 million is available annually.

RideLink

This program is operated by SANDAG and covers a variety of transportation management activities including projects such as bicycle lockers and security devices. These will be provided, installed and maintained for public agencies at no cost to the requesting agency. RideLink also offers a bicycle locker loan program to private sector entities.

Developer Impact Fees

As a condition for development approval, municipalities can require developers to provide certain infrastructure improvements, which can include bikeway projects. These projects have commonly provided Class 2 facilities for portions of on-street, previously planned routes. They can also be used to provide bicycle parking or shower and locker facilities. The type of facility that should be required to be built by developers should reflect the greatest need for the particular project and its local area. Legal challenges to these types of fees have resulted in the requirement to illustrate a clear nexus between the particular project and the mandated improvement and cost.

New Construction

Future road widening and construction projects are one means of providing on-street bicycle facilities. To ensure that roadway construction projects provide bike lanes where needed, it is important that the review process includes input pertaining to consistency with the proposed system. Future development in the City of Imperial Beach will contribute only if the projects are conditioned.

Restoration

Cable TV and telephone companies sometimes need new cable routes within public rights-of-way. Recently, this has most commonly occurred during expansion of fiber optic networks. Since these projects require a significant amount of advance planning and disruption of curb lanes, it may be possible to request reimbursement for affected bicycle facilities to mitigate construction impacts. In cases where cable routes cross undeveloped areas, it may be possible to provide for new bikeway facilities following completion of the cable trenching, such as sharing the use of maintenance roads.

Other Sources

Local sales taxes, fees and permits may be implemented as new funding sources for bicycle projects. However, any of these potential sources would require a local election. Volunteer programs may be developed to substantially reduce the cost of implementing some routes, particularly multi-use paths. For example, a local college design class may use such a multi-use route as a student project, working with a local landscape architectural or engineering firm. Work parties could be formed to help clear the right-of-way for the route. A local con-

struction company may donate or discount services beyond what the volunteers can do. A challenge grant program with local businesses may be a good source of local funding, in which the businesses can "adopt" a route and help to construct and maintain it.

8.4.5 Most Likely Sources

According to City of Imperial Beach sources, the most likely local sources of bikeway funding are the following:

1) TDA/CIP (Transportation Development Act, Capital Improvement Projects)
2) TIF (Traffic Impact Fee Fund)
3) City of Imperial Beach General Fund
4) Developer Impact Fees
5) BTA (Bicycle Transportation Account)
6) APCB (Air Pollution Control Board)

These facility guidelines are intended to guide development of all types of bikeway facilities. The first section considers the necessary planning aspects of bikeway system design in general. The following section discusses general physical design guidelines. Subsequent sections provide physical design information for specific classes of bikeway facilities.

8.5 Bikeway Planning

Successfully implementing a bikeway system involves careful planning that considers a number of issues, including setting up appropriate mechanisms to take advantage of bikeway opportunities as they become available. Author and bicycle planning expert Susan Pinsof has perhaps described the process most succinctly:

"A comprehensive, affordable approach to bicycle planning involves maximizing the usefulness of existing infrastructure by improving the safety of shared roadway space; using opportunities, such as available open space corridors for trails; creating more "bicycle-friendly" communities through planning, design and regulation; and addressing the need for bicycle safety education and encouragement."

8.5.1 Local Emphasis

Cycling is primarily a local activity since most trips do not exceed five miles. Experienced cyclists routinely ride further than this and their cross-community travel should be accommodated. However, if it is a community goal to make localized cycling a viable option for personal transportation, then cyclist mobility must be improved and enhanced throughout the community, especially to important local destinations. Even though State or Federal policies may influence or even dictate some design and implementation decisions, it is local decisions that will most significantly affect the potential for cycling within a community.

8.5.2 Master Plan Process

The basis for a bicycle-friendly community can be established by instituting appropriate policies through the development and adoption of this bicycle master plan. A program of physical improvements and workable implementation strategies that reflects local needs was developed as part of this master plan. A bicycle master plan will be of little value if it is not part of an active and ongoing planning process that continually seeks to integrate cycling considerations into all areas of local planning.

Within this master plan, facility design guidelines have been tailored to local conditions, but are also consistent with national guidelines, such as the AASHTO Guide to Development of Bicycle Facilities. State guidelines are also referenced, specifically, Caltrans Highway Design Manual, Chapter 1000, Bikeway Planning and Design and the Caltrans Traffic Manual. Elements of these guidelines without relevance to the region have been excluded.

8.5.3 "Institutionalizing" Bicycle Planning

Achieving implementation of this master plan will be greatly expedited by "institutionalizing" bicycle planning, a concept first developed by Peter Lagerway of the city of Seattle, Washington as part of his efforts as the city's pedestrian and bicycle coordinator. The term refers to coordinating local planning and regulatory functions in the development of a program of improvements. The three elements needed to institutionalize bicycle planning on a local level are a bicycle advisory committee, a bicycle coordinator and committed public officials.

1. Bicycle Advisory Committee

Public involvement can be promoted through the formation of a bicycle advisory committee as a new city committee, or as a subcommittee of an appropriate existing committee. Its primary benefit would be in providing an avenue for public participation and support.

2. Bicycle Coordinator

City government involvement can occur through the designation of a bicycle coordinator. For a city the size of Imperial Beach, this may be a part-time position or integrated with an existing position, but this does not diminish its importance. Since a truly comprehensive bicycle planning effort will involve many city departments including Public Works, Parks and Recreation, Planning and Traffic Engineering, as well as local school boards and the Sheriffs Department, the bicycle coordinator would be in a position to organize interdepartmental efforts and make certain that bicycle concerns are integrated into other city activities in the planning stages, as well as coordinated with adjacent communities and jurisdictions.

3. Public Officials

The third aspect of institutionalization of bicycle planning involves obtaining the commitment of public officials. Leadership for bicycle improvements may already come from public officials, but even if it does not, officials will be more likely to be supportive if they can be certain their constituency wants a more bicycle-friendly community.

Figure 8.3 Bikeway Facility Funding Summary

Grant Source	Due Date	Agency	Annual Total	Match Required	Eligible Applicants	Eligible Bikeway Project Types			Remarks
						Com	Rec	Safety	
State Sources									
State Highway Account (SHA): Bicycle Transportation Account (BTA)	Consult Local Assistance Office	Caltrans	$7,200,000/yr. state-wide	10% local match required	Jurisdictions with an adopted BikewayPlan	✘		✘	Available for planning grants
Transportation Development Act (TDA) Section 99234	April 2, annually			none	Local agencies	✘	✘	✘	2% of TDA total
AB 2766 Vehicle Registration Funds		Caltrans				✘	✘		Competitive program for projects that benefit air quality
Vehicle Registration Surcharge Fee (AB 434) RCF	July	APCB		none	Local agencies, transit operations, others	✘	✘	✘	Competitive program for projects that benefit air quality
Vehicle Registration Surcharge Fee (AB 434) PMF	April	APCB	40% from grant source	none	Local jurisdictions	✘	✘	✘	Funds distributed to county communities based on population
Developer Fees or Exactions	Ongoing	Cities	Project-specific	none		✘	✘	✘	Mitigation required during land use approval process
State Gas Tax (local share)	Monthly allocation	Allocated by State Auditor-Controller		none	Local jurisdictions	✘		✘	Major Projects, >$300,000
Flexible Congestion Relief Program (FCRP)	Dec. STIP cycle	Caltrans	$300 million/yr. state-wide		Cities, counties, transit operations, Caltrans	✘	✘		Must be included in an adopted RTP, STIP, CMP or RTIP
State and Local Transportation Partnership Program (SLPP)	June 30	Caltrans	Est. $200 million/yr. state-wide	none	Cities, counties or assess. districts authorized to impose taxes/fees and construct public trans. facilities	✘	✘		Road projects with bike lanes are eligible
Caltrans Minor Capital Program	Ongoing after July 1	Caltrans	Discretionary (Est. $4 million/yr. for District 11)	none	State and local agencies for projects >$300,000	✘			Projects must be on state highways; such as upgraded bike facilities
Environmental Enhancement and Mitigation Program (EEM)	Nov. 1 annually	State Resources Agency	$10 million/yr. state-wide	none required, but favored	Local, state, federal government and non-profit agencies	✘	✘		Projects that enhance or mitigate existing or future transportation projects
Petroleum Violation Escrow Account (PVEA)	March 1	Budget Act for Caltrans, or special legislation for allocation to local agencies	Varies	none	State and local jurisdictions	✘	✘		Projects must save energy, provide restitution to the public and be approved by CA Energy Commision and US DOE
Community Based Transportation Planning Demonstration Grant Program	November	Caltrans	$3 million annually	20% local match required	Local and state agencies, MPOs, RTPAs, private, non-profit and community organizations	✘		✘	Projects must have a transportation component or objective
Habitat Conservation Fund Grant Program (HCF)	October	CA Dept of Park and Recreation	$2 million	50% local match required	Cities, counties and eligible districts		✘		Will only be available until July 1, 2020
Office of Traffic Safety Program (OTS)	January 31	Office of Traffic Safety	Varies	none	Local, state, federal government, school districts, fire dpeartments, state colleges and universities, emergency service providers and non-profit agencies	✘		✘	Program objective is to reduce motor vehicle fatalities and injuries through a national highway safety program. Program to include: education, enforcement and engineering
Safe Routes to School Program (SR2S)	May	Subset of the Hazard Elimination Safety Program	$20 million annually	10% local match required	Cities and counties within California	✘		✘	Maximum grant shall not exceed $450,000 of federal funds per project
State Transportation Improvement Program (STIP)	Every 4 years	Regional Transportation Planning Agency	Varies	non	Cities, counties transit operators and Caltrans	✘		✘	Gives metropolitan regions more control over how state tranportation funds are invested

Grant Source	Due Date	Agency	Annual Total	Match Required	Eligible Applicants	Eligible Bikeway Project Types			Remarks
						Com	Rec	Safety	
Federal Sources									
Land and Water Conservation Act of 1965	Dec.	State Parks and Recreation Department		50%			X		Funding subject to North/South split. Funds for outdoor recreation projects
TEA21 - Surface Transportation Program (STP)	June 1	Caltrans, FHWA		20% non-federal match	Federally certified jurisdictions				STP funds may be exchanged for local funds for non-federally certified local agencies. No match required if project improves safety
TEA21 - Tranportation Enhancement Activities (TEA)	STIP cycle	FHWA		20% non-federal match	Federally certified jurisdictions	X	X		Contact county
TEA21 - Bridge Replacement and Rehabilitation Program (BRP)	Jan/list of projects	Caltrans	$85 million/yr. state-wide	20%	Cities, counties, parks/recreation districts and air districts	X	X		Contact Caltrans Division of Structures, Office of Local Programs, Program Manager
TEA21 - National Highway System		Caltrans				X	X		Bike projects must provide a high degree of safety
TEA21 - Scenic Byways Program		Caltrans	$30 million/yr. state-wide		Local government agencies		X		Should apply first for TEA funds until TEA runs out
TEA21 - Public Lands Highway Program									
1. Forest Highway Program	Oct. 30	Caltrans	$15 million/yr. state-wide		Caltrans, local jurisdictions and federally funded programs (USFS, BLM)	X	X		For roads and bikeways leading to and serving National Forests
2. Discretionary Program	June 7	Caltrans	Varies - averages $7 million/yr. state-wide		Caltrans, local jurisdictions and federally funded programs (USFS, BLM)	X	X		For roads and bikeways leading to and serving National Forests
Congestion Mitigation and Air Quality Improvement Plan (CMAQ)	Annually to Multi-Year. Depends on MPO	Caltrans	$400 million/yr. state-wide	20% non-federal match	Cities, counties, transit operators, Caltrans, Metropolitan Planning Organizations, Non-Profit and private entities	X		X	The amount of CMAQ Funds depends on the state's populationshare and on the degree of air pollution
Regional Trails Program (RTP)	October	Dept of Parks and Recreation	$3 million annually	20% non-federal match	Local jurisdictions, state agencies and non-profit organizations		X	X	Funds are for both mototrized and non-motorized categories
Rivers, Trails and Conservation Assistance Program (RTCA)	August	National Park Service			Local jurisdictions, state agencies and citizen groups		X		Expenditures include bikeway plans, corridor studies and trails assistance


SHARE
THE
ROAD

9 Design Guidelines

These facility guidelines are intended to guide development of all bikeway facility types. The first section considers the necessary planning aspects of bikeway system design in general. The following section discusses general physical design guidelines. Subsequent sections provide physical design information for specific classes of bikeway facilities.

9.1 Bikeway Planning

Successfully implementing a bikeway system involves careful planning that considers a number of issues, including setting up appropriate mechanisms to take advantage of bikeway opportunities as they become available. Author and bicycle planning expert Susan Pinsof has perhaps described the process most succinctly:

"A comprehensive, affordable approach to bicycle planning involves maximizing the usefulness of existing infrastructure by improving the safety of shared roadway space; using opportunities, such as available open space corridors for trails; creating more 'bicycle-friendly' communities through planning, design and regulation; and addressing the need for bicycle safety education and encouragement."

9.1.1 Local Emphasis

Cycling is primarily a local activity since most trips do not exceed five miles. Experienced cyclists routinely ride further than this and their cross-community travel should be accommodated. However, if it is a community goal to make localized cycling a viable option for personal transportation, then cyclist mobility must be improved and enhanced throughout the community, especially to important local destinations. Even though State or Federal policies may influence or even dictate some design and implementation decisions, it is local decisions that will most significantly affect the potential for cycling within a community.

9.1.2 Master Plan Process

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Within this master plan, facility design guidelines have been tailored to local conditions, but are also consistent with national guidelines, such as the AASHTO Guide to Development of Bicycle Facilities. State guidelines are also referenced, specifically, Caltrans Highway Design Manual, Chapter 1000, Bikeway Planning and Design and the Caltrans Traffic Manual. Elements of these guidelines without relevance to the region have been excluded.

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Bicycle Advisory Committee

Public involvement can be promoted through the formation of a bicycle advisory committee as a new city committee, or as a subcommittee of an appropriate existing committee. Its primary benefit would be in providing an avenue for public participation and support.

Bicycle Coordinator

City government involvement can occur through the designation of a bicycle coordinator. For a city the size of Imperial Beach, this may be a part-time position or integrated with an existing position, but this does not diminish its importance. Since a truly comprehensive bicycle planning effort will involve many city departments including Public Works, Parks and Recreation, Planning and Traffic Engineering, as well as local school boards and the Sheriffs Department, the bicycle coordinator would be in a position to organize interdepartmental efforts and make certain that bicycle concerns are integrated into other city activities in the planning stages, as well as coordinated with adjacent communities and jurisdictions.

Public Officials

The third aspect of institutionalization of bicycle planning involves obtaining the commitment of public officials. Leadership for bicycle improvements may already come from public officials, but even if it does not, officials will be more likely to be supportive if they can be certain their constituency wants a more bicycle-friendly community.

9.1.4 Primary Planning Considerations

The safety, efficiency and enjoyment of the bike facility by expected users should be the primary considerations employed in the planning of new bicycle facilities. More specifically, such considerations should include the following:

- Direct and convenient alignment to serve trip origins and destinations;
- Access to and from existing and planned bicycle facilities;
- Avoiding abrupt facility discontinuity;
- Avoiding steep grades whenever possible;
- Adequate lighting and sight lines;
- Convenient bicycle parking at destinations; and
- Adequate commitment to maintenance.

9.1.5 Integration with Other City Plans and Programs

Bikeway facility planning requires a high level of coordination because it is directly affected by the planning decisions of other City departments, as well as those of adjacent communities, the county, regional and state agencies. Land use, zoning, street design, open space and park planning all affect how bicycle-friendly a community can be. For examples, land use patterns affect cycling by determining the locations of trip origins and destinations by such means as creating areas of employment and housing densities sufficient to sustain bicycle facilities, or by providing a balance of housing and jobs by encouraging multi-use development. Access or bicycle parking facilities can often be included in developments at a low cost. Also, the provision of better access and connections between developments for cyclists and pedestrians may be more easily provided if the need is understood and articulated as early as possible in the planning process.

Effective bicycle planning requires review of regional transportation plans, local street plans, park and open space plans and even site plan review. Transportation plans provide opportunities for low cost improvements to be designed into subsequent projects. Local street plans provide opportunities to implement changes that make streets more conducive to cycling using techniques such as traffic calming to reduce motor vehicle speeds. Park and open space planning may provide opportunities to acquire greenways and to build multi-use trails. Site plan review provides opportunities to ensure that project design accommodates cyclists through the provision of improvements such as access or parking facilities and that the project's vehicular traffic does not decrease the safety of cyclists of adjacent facilities.

9.1.6 Education and Encouragement

Education and encouragement of cycling are important elements of any bicycle planning effort and can occur through instructional venues such as school curricula and through the efforts of large employer-based transportation programs. There is no shortage of educational materials available through a number of private and government organizations. The

dissemination of meaningful information can also be augmented by the participation of local businesses such as bike shops, especially since they have a vested interest in promoting safe cycling in Imperial Beach. Education and encouragement rarely receive the attention they deserve even when included in bikeway master plans and this is where a bicycle co-ordinator can be of help in developing appropriate programs.

9.1.7 Regulating Land Use and Community Design to Benefit Cycling

Land use and design options are largely determined by regulatory functions that, in turn, help to define community character and functionality. These regulatory functions such as subdivision regulations, zoning requirements and developer exactions are also often used to set requirements for amenities in new development projects. These same regulations can be used to help define development patterns more conducive to cycling such as incorporating more mixed use, higher densities and connections between communities and land uses. Street patterns and hierarchy can greatly affect average daily (motor vehicle) trips (ADTs), connectivity and motor vehicle speeds, which in turn positively or negatively affects cycling. Street design can be modified to discourage high motor vehicle speeds and to provide width for a bike lane. Linear open space can become land for greenway routes that benefit all non-motorized users, not just cyclists.

Though prioritization of bikeway projects is defined by State and local decisions, it is Federal funding and policies that currently encourage the use of transportation funds for bicycle and pedestrian projects. However, Federal funding cannot be counted upon as a reliable source for the foreseeable future since it depends on the political nature of legislative action. Bicycle planning cannot sustain itself on the occasional Federal grant. Future local implementation will more likely depend on instituting bicycle improvements as part of infrastructural projects, which is when they are most cost-effective.

Similarly, the most economical way to include bicycle facilities in private development is through initial project planning and design, not as an afterthought. Ordinances can be written that bikeway systems be included as part of new developments. An effort should be made to show developers that such requirements are worthwhile because they create well established marketing advantages gained from providing pedestrian and bicycle amenities. Ordinances can also require bicycle amenities such as bicycle parking, showers and lockers at employment sites. In all cases, a bicycle master plan is important for establishing priorities for such public/private projects.

Review of developments for transportation impacts should address how on-site bicycle facilities are planned. Bicycle storage racks should be provided at commercial facilities at locations convenient to building entrances and covered from the elements. This is especially important at retail and service establishments. At employment sites, secure bicycle racks and/or lockers should be provided. For outdoor parking, lockers are preferred because they completely secure the bicycle from theft of the entire bicycle or its parts and are weather-proof.

Requiring developments near commuter rail stations to provide access pathways to these transit centers as part of urban in-fill may improve multi-modal connections for pedestrians and cyclists alike. Other developers should contribute to bicycle master plan implementation projects in newly developing areas. Park land dedication or fees in lieu of dedication is another possible component of strategies to acquire local trail and bicycle path rights-of-way.

9.1.8 Bicycle Parking Facilities

The selection and placement of bicycle racks is an important issue because the lack of secure parking keeps many people from using their bikes for basic transportation. Leaving a bicycle unattended, even for short periods, can easily result in damage or theft. Not being able to find a bike rack or finding one that does not work or is not conveniently located is a frustrating experience.

Whenever possible, the racks should be placed within 50 feet of building entrances where cyclists would naturally transition to pedestrian mode. The rack placement would ideally allow for visual monitoring by people within the building and/or people entering the building. The placement of the racks should minimize conflicts with both pedestrians and motorized traffic. All bicycle parking provided should be on paving, and located a minimum of two feet from a parallel wall, and four feet from a perpendicular wall (as measured to the closest center of the rack).

Like most American municipalities, no real facility inventory is available for Imperial Beach. However, there are bicycle parking facilities at the larger retail centers, at City Hall, Community Centers and some parks and other City facilities.

Imperial Beach could implement a minimum bicycle parking ordinance like that of the City of Encinitas (EMC 30.54.030.C) that defines bicycle parking facilities as "...stationary racks or devices designed to secure the frame and wheel of the bicycle." The ordinance lists the following provisions:

- Buildings housing administrative/professional office space, shopping centers and other commercial uses of less than 20,000 square feet of floor area must provide a minimum of three bicycle parking spaces. Facilities with more than 20,000 square feet must supply a minimum of five spaces.

- Shopping centers with over 50,000 square feet of gross floor area must supply one bicycle parking space for every 33 required automobile spaces.

- Restaurants of less than 6,000 square feet of floor area must provide two spaces and restaurants with more than 6,000 square feet must provide five spaces.

- Recreation facilities must provide one bicycle space per 33 required automobile parking space.

- Hospitals and churches must provide eight bicycle spaces.

The City should continue to encourage the use of alternate forms of transportation by also requiring the provision of shower facilities for employers with greater than a specified number of employees.

To help achieve parity with drivers, the City could codify by ordinance, or develop a program to provide bike racks in existing commercial areas, and in new or existing multi-family development designed without private garages. These programs should include bike rack design and installation standards such as those in the following section.

The following paragraphs and graphics focus on outdoor installations using racks intended to accommodate conventional, upright, single-rider bicycles and the use a solid, U-shaped lock, or a cable lock, or both.

Rack Element

The rack element is the part of the bike rack that supports one bicycle. It should support the bicycle by its frame in two places, prevent the bicycle wheel from tipping over, allow the frame and one or both wheels to be secured and support bicycles with unconventional frames.

"Inverted U" type racks are most recommended because each element can support two bicycles. Commonly used "wave" type racks are not recommended because they support the bicycle at only one point. Cyclists often park their bikes parallel with the rack, instead of perpendicular as intended, which reduces the rack capacity by half.

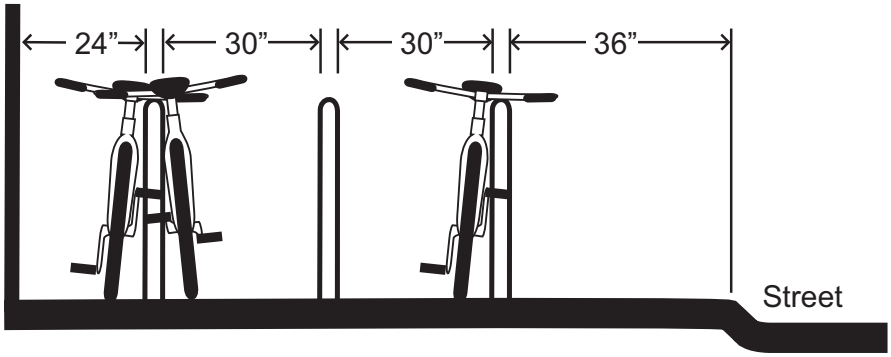
The rack element should also resist being cut or detached using common hand tools, especially those that can be concealed in a backpack. Such tools include bolt cutters, pipe cutters, wrenches and pry bars.

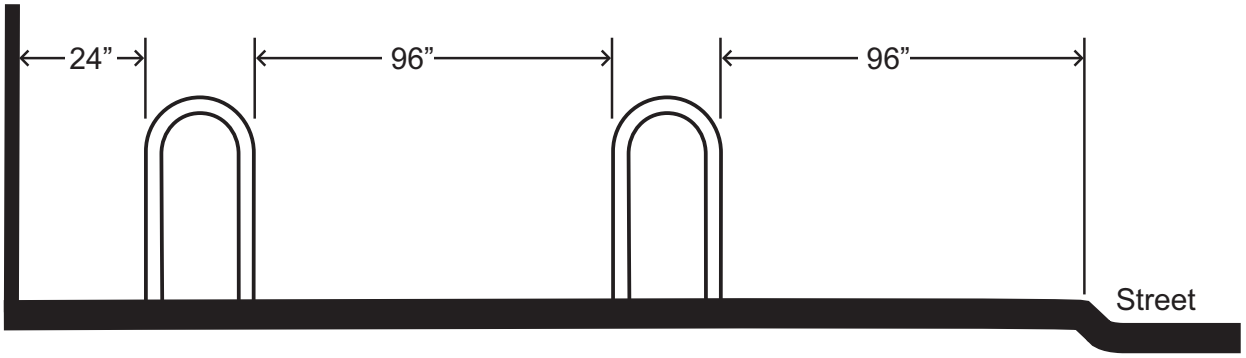
Rack

The rack itself is one or more rack elements joined on a common base or arranged in a regular array and fastened to a common mounting surface.

The rack elements may be attached to a single frame or remain single elements mounted in close proximity. They should not be easily detachable from the rack frame or easily removed from the mounting surface. The rack should be anchored so that it cannot be stolen with the bikes attached such as with vandal-resistant fasteners.

The rack should provide easy, independent bike access. Typical inverted “U” rack elements mounted in a row should be placed on 30” centers. Normally, the handlebar and seat heights will allow two bicycles to line up side-by-side in opposite directions. If it is too inconvenient and time-consuming to squeeze the bikes into the space and attach a lock, cyclists will look for an alternative place to park or use one rack element per bike and reduce the projected parking capacity by half.

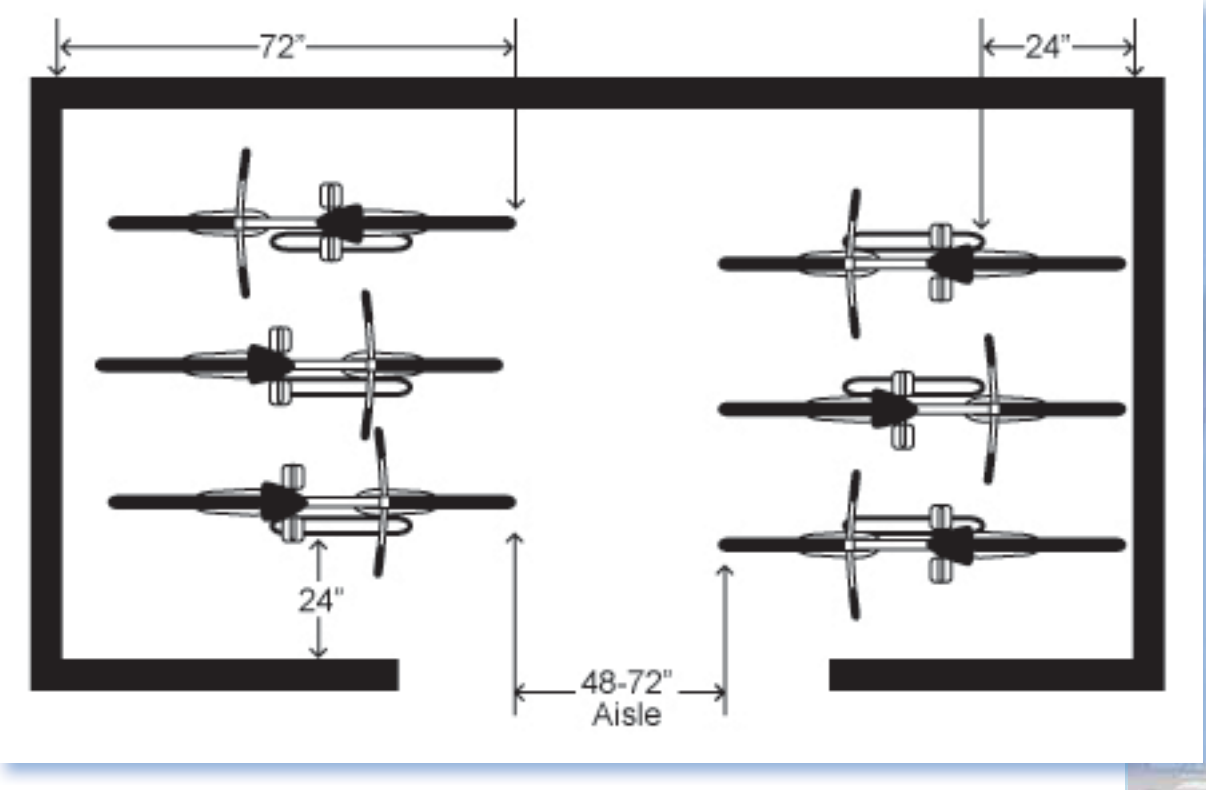




Rack Area

The rack area is a bicycle parking lot where racks are separated by aisles.

A rack area or “bicycle parking lot” is an area where more than one rack is installed separated by aisles measured from tip to tip of bike tires across the space between racks. The minimum separation between aisles should be 48 inches, which provides enough space for one person to walk one bike. In high traffic areas where many users park or retrieve bikes at the same time, such as at colleges, the recommended aisle width is 72 inches. The depth of each row of parked bicycles should also be 72 inches.



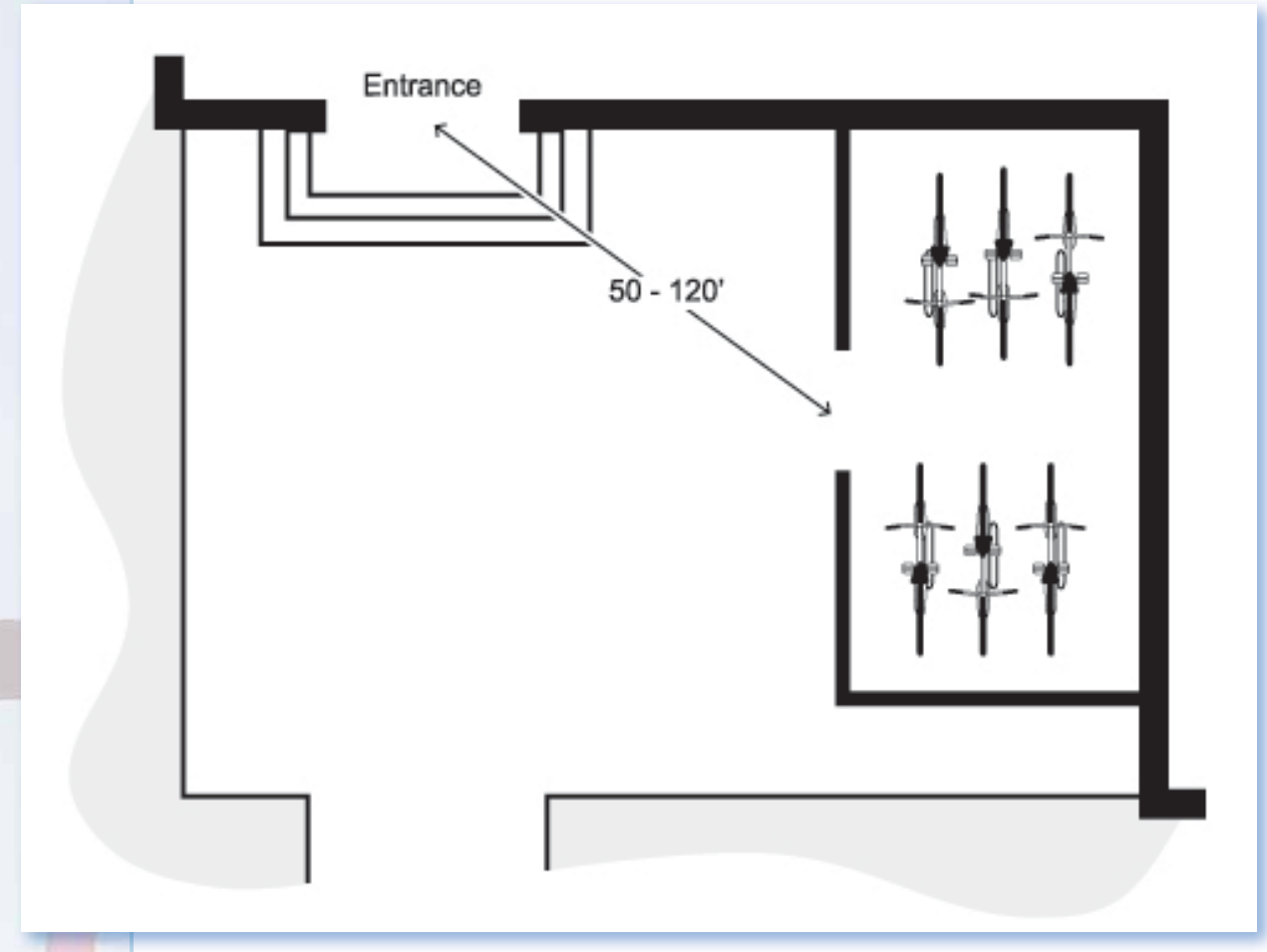
Large rack areas in high turnover areas should have more than one entrance. If possible, the rack area should be protected from the elements. Even though cyclists are exposed to sun, rain and snow while en route, covering the rack area keeps the cyclist more comfortable while parking, locking the bike and loading or unloading cargo. A covering will also help keep the bicycle dry, especially the saddle.

Rack Area Site

The rack area site is the relationship of a rack area to the building entrance or approach. In general, smaller, conveniently located rack areas should serve multiple buildings, rather than a larger combined, distant one. Racks far from the entrance or perceived to be where bikes will be vulnerable to vandalism will not receive much use.

Rack area location in relationship to the building it serves is very important. The best location is immediately adjacent to the entrance it serves, but racks should not be placed where they can block the entrance or inhibit pedestrian flow. The rack area should be located along a major building approach line and clearly visible from the approach.

The rack area should be no more than a 30-second walk (120 feet) from the entrance it serves and should preferably be within 50 feet. A rack area should be as close or closer than the nearest car parking space, be clearly visible from the entrance it serves and be near each actively used entrance.



Creative Design

There are many creative, three-dimensional bicycle parking racks that work very well. Creative designs should carefully balance form with function. Whatever the rack configuration, the critical issue is that the rack element supports the bike in two places and allows the bicycle to be securely locked. All racks must be carefully manufactured and maintained to prevent weaknesses at the joints that might compromise bicycle security.

9.1.9 Locating Bicycle Facilities on Roadways

The appropriateness of a roadway facility for bicycling is influenced by a number of factors. These factors can generally be classified into the following categories:

Land Use and Location Factors

These factors represent the most significant category affecting compatibility. Since bicycle trips are generally shorter than motor vehicle or mass transit trips, there must be a manageable distance between origins and destinations, such as between residential areas and places of employment. There are certain key land uses, which are especially likely to generate bicycle traffic if good bicycle facilities are available. These consist of, but are not limited to, transit centers, schools, employment centers with nearby residential areas, recreation areas and mixed use areas.

Physical Constraint Factors

These consist of roadway geometric or physical obstacles to bicycling, which are difficult or costly to remedy. For example, a roadway may be appropriate because of location factors, but not appropriate because of the existence of physical constraints to bicycling such as a narrow bridge, insufficient right-of-way or intersections with restricted lane widths resulting from lane channelization. The feasibility of correcting these physical constraints must be weighed in designating bikeways.

Traffic Operations Factors

These include traffic volume, speed, the number of curb cuts or conflict points along the roadway, sight distance and bicycle-sensitive traffic control devices. Experienced cyclists will use roadways even if they have limiting traffic operational factors, but less confident cyclists will perceive such roadways as unsafe and intimidating. These roadway facilities should be designed or improved to accommodate cyclists through the shared use of roadways. However, they are inappropriate for full designation as bikeways.

Other safety issues such as maintenance and pavement repair are also important considerations in the designation of bikeways, but do not directly affect the planning aspects of appropriate facilities.

9.1.10 Integrating Bicycle Facilities into the Roadway Planning Process

Planning for bicycle facilities on roadways should begin at the very earliest stage of project development on all sizes and types of roadway projects. Even the smallest roadway reconstruction project could result in a missed opportunity if cyclists are not taken into consideration at the initiation of the project. At the municipal level, planners should address these roadway planning issues in the comprehensive context of the Circulation Element in the City's General Plan.

The Bikeway Master Plan is a planning tool for the development of bikeway facilities. It is intended to complement the City's adopted roadway standards, and the General Plan's Circulation Element. The roadway standards rely on the Bikeway Master Plan to provide guidance on the location, type and recommended design of bikeway facilities.

The following procedure offers the planner and designer general guidance in determining the need for bikeways during the usual phases of project development.

Needs Assessment

The first step in the planning process for any transportation project is the assessment of needs. Existing and planned land use, current and projected traffic levels and the special needs of the area population are examined. There are circumstances in which a portion of the transportation need might be served by non-motorized means, as well as locations where existing bicycle demand would be better served by improved facilities. The following land use and location factors assist in recognizing the potential for non-motorized travel and evaluating the needs of cyclists at the street level. The roadway:

- Serves an activity center, which could generate bicycle trips;
- Is included on a county or municipal bicycle master plan;
- Provides continuity with or between existing bicycle facilities, including those of adjacent cities;
- Is located on a roadway, which is part of a mapped bike route or utilized regularly by local bicycle clubs;
- Passes within two miles of a transit center;
- Passes within two miles of a high school or college;
- Passes within a half mile of an elementary school or middle school;
- Passes through an employment center, especially if there is a significant residential area within a three mile radius; or
- Provides access to a recreation area or otherwise serves a recreation purpose.

If any one of these factors exists, the roadway has the potential to attract less experienced bicycle riders and/or significant numbers of advanced riders. As a result, it should be considered as potentially appropriate for designation as a bikeway.

The planner should include a description of the potential significance of the roadway as a bikeway facility in the project initiation or scoping document that will be forwarded to the project designer. If the planner determines that the project is potentially appropriate for

designation as a bikeway, the nature of potential bicycle use should be addressed, including factors affecting roadway design, such as roadway truck volumes or intersections.

Preliminary Engineering

Roadway facilities that have been determined through needs assessment to be potentially appropriate for bikeways should be analyzed to determine whether any physical constraints exist that may limit the facility type that could be provided. The following factors should be considered:

- Sufficient right-of-way exists, or additional right-of-way can be acquired to allocate the required space for a bikeway;
- Physical impediments or restrictions exist, but they can be avoided or removed to allow for the required pavement width to provide a bikeway;
- Bridges allow for bicycle access in accordance with bikeway standards; and
- Travel or parking lanes can be reduced in width or eliminated to allow space for bikeways.

If these factors occur, a bikeway should be recommended at the completion of the preliminary engineering phase for the following situations:

- Transportation facilities or segments that connect bicycle traffic generators within five miles of each other; or
- Segments of transportation facilities that provide continuity with existing bicycle facilities.

If physical constraint factors that preclude allocation of space and designation of bikeways exist along a particular roadway and cannot be avoided or remedied, these factors should be reported to the project manager in the final design phase and alternative design treatments should be generated.

Planning and engineering should consider more than roadway cross-sections. Often, the most difficult potential areas of conflict are at intersections. In general, high speed interchanges, merge lanes and wide radius curbs are unsafe for cyclists and should be avoided.

Final Design And Facility Selection

Class 2 facilities are usually more suitable in urban settings on roads with high traffic volumes and speeds. Class 3 facilities are often used in urban settings to guide cyclists along alternate or parallel routes that avoid major obstacles, or have more desirable traffic operational factors.

In rural settings, Class 2 facilities are not usually necessary to designate preferential use. On higher volume roadways, wide shoulders offer cyclists a safe and comfortable riding area. On low volume roadways, most cyclists prefer the appearance of a narrow, low speed country road.

Table 1 (following page) recommends the type of bikeway and pavement width for various traffic conditions. For locations where pavement widths do not meet the criteria listed in the table, the local municipal bicycle authority should be consulted to assist in the decision-making process.

Where physical obstructions exist that can be removed in the future, the roadway facility should be designed to meet bikeway space allocation requirements and upgraded and designated when the physical constraint is remedied (i.e., bridge is replaced and improved to allow designated facility).

The final design should be coordinated with the bicycle coordinator for review and approval prior to construction.

- Existing and projected traffic volumes and speeds;
- Existence of parking (Can parking be restricted or removed to allow better sight distances?);
- Excessive intersection-conflict points (Can intersection-conflict points be reduced along roadways?);
- Turn lanes at intersections that can be designed to allow space for cyclists;
- Sections with insufficient sight distance or roadway geometrics be changed; or
- Traffic operations be changed or "calmed" to allow space and increased safety for cyclists.

Table 9-1: Recommended Lane Widths

Posted Speed Limit	Urban w/ Parking	Urban w/o Parking	Rural
1,200 to 2,000 ADTs			
<30 mph	12 ft. SL	11 ft. SL	10 ft. SL
31-40 mph	14 ft. SL	14 ft. SL	12 ft. SL
41-50 mph	15 ft. SL	15 ft. SL	3 ft. SH
>50 mph	NA	4 ft. SH	4 ft. SH
2,000 to 10,000 ADTs			
<30 mph	14 ft. SL	12 ft. SL	12 ft. SL
31-40 mph	14 ft. SL	14 ft. SL	3 ft. SH
41-50 mph	15 ft. SL	15 ft. SL	4 ft. SH
>50 mph	NA	6 ft. SH	6 ft. SH
More than 10,000 ADTs or Trucks over 5%			
<30 mph	14 ft. SL	14 ft. SL	14 ft. SL
31-40 mph	14 ft. SL	4 ft. SH	4 ft. SH
41-50 mph	15 ft. SL	6 ft. SH	6 ft. SH
>50 mph	NA	6 ft. SH	6 ft. SH

Notes:

Primarily applicable to Class 3 and "Undesignated" routes.

SH = Shoulder, SL = Shared Lane

Shared lane is acceptable for volumes less than 1,200 ADTs.

Provide 8' shoulder for volumes greater than 10,000 ADTs.

9.2 General Physical Guidelines

The following sections cover physical design guidelines applicable to all bikeway facility types. Guidelines specific to Class 1, 2 and 3 facilities are covered in subsequent sections.

9.2.1 Pavement Width

At a minimum, all roadway projects shall provide sufficient width of smoothly paved surface to permit the shared use of the roadway by bicycles and motor vehicles.

Table 1 is based on the FHWA publication, *Selecting Roadway Design Treatments to Accommodate Bicycles*. Pavement widths represent minimum design treatments for accommodating bicycle traffic. These widths are based on providing sufficient pavement for shared use by bicycle and motor vehicle traffic and should be used on roadway projects as minimum guidelines for bicycle compatible roads. Note that these are recommendations that do not supersede current City roadway standards, and they apply to Class 3 routes only.

Considerations in the selection of pavement width include traffic volume, speed, sight distance, number of large vehicles (such as trucks) and grade. The dimensions given in Table 1 for shared lanes are exclusive of the added width for parking, which is assumed to be eight feet. On shared lanes with parking, the lane width can be reduced if parking occurs only intermittently. On travel lanes where curbs are present, an additional one foot is necessary.

On very low volume roadways with ADTs of less than 1,200, even relatively high speed roads pose little risk for cyclists since there will be high probability that an overtaking motor vehicle will be able to widely pass a bicycle. When an overtaking car is unable to immediately pass a bicycle, only a small delay for the motorist is likely. Both cyclists and motorists jointly use these types of roadways in a safe manner and widening of these roads is not usually recommended. Costs of providing widening of these roads can seldom be justified based on either capacity or safety.

Similarly, moderately low volume roadways with ADTs between 1,200 and 2,000 generally are compatible for bicycle use and will have little need for widening. However, since there is a greater chance of two opposing cars meeting at the same time as they must pass a cyclist, providing some room at the outside of the outer travel lane is desirable on faster speed roadways. On low speed roadways, motorists should be willing to accept some minimal delay.

With ADTs from 2,000 to 10,000, the probability becomes substantially greater that a vehicle overtaking a bicycle may also meet another oncoming vehicle. As a result, on these roads, some room at the edge of the roadway should be provided for cyclists. This additional width should be two to three feet added to a typical 10-foot outer travel lane. At low speeds, such as below 25 m.p.h., little separation is needed for both a cyclist and a motorist to feel comfortable during a passing maneuver. With higher speeds, more room is needed.

At volumes greater than 10,000 ADTs, vehicle traffic in the curb lane becomes almost continuous, especially during peak periods. As a result, cyclists on these roadways require separate space to safely ride, such as a Class 2 facility. In addition, improvements to the roadway edge and the shoulder area will be valuable for motorists as well.

Caltrans guidelines for highways recommend that a full eight-foot paved shoulder be provided for State highways. On highways having ADTs greater than 20,000 vehicles per day, or on which more than five percent of the traffic volume consists of trucks, every effort should be made to provide such a shoulder for the benefit of cyclists, to enhance the safety of motor vehicle movements and to provide “break down” space, as well as a Class 2 facility. Otherwise, the highway should probably not be designated as a bicycle facility.

9.2.2 Sight Distance

Roadways with adequate sight distance will allow a motorist to see, recognize, decide on the proper maneuver, and initiate actions to avoid a cyclist. Adequate decision sight distance is most important on high speed highways and narrow roadways where a motorist would have to maneuver out of the travel lane to pass a cyclist.

The pavement widths given in Table 1 are based on the assumption that adequate sight distance is available. In situations where there is not adequate sight distance, provision of additional width may be necessary.

9.2.3 Truck Traffic

Roadways with high volumes of trucks and large vehicles, such as recreational vehicles, need additional space to minimize cyclist/motorist conflicts on roadways. Additional width allows trucks to overtake cyclists with less maneuvering and the cyclists will experience less lateral force from truck drafts. This additional width will also provide greater sight distance for following vehicles.

Although there is no established threshold, additional space should be considered when truck volumes exceed five percent of the traffic mix, or on roadways that serve campgrounds, or where a high level of tourist travel is expected using large recreational vehicles. Where truck volumes exceed 15 percent of the total traffic mix, widths shown on Table 1 should be increased by one foot minimum.

9.2.4 Steep Grades

Steep grades influence overtaking of cyclists by motorists. Inexperienced cyclists climbing steep grades are often unsteady (wobbly) and may need additional width. Also, the difference in speed between a slow, climbing cyclist and a motor vehicle results in less time for the driver to react and maneuver around a cyclist. Motor vehicle slowing on a steep grade to pass a cyclist can result in a diminished level of service.

9.2.5 Unavoidable Obstacles

Short segments of roadways with multiple unavoidable obstacles that result in inadequate roadway width are acceptable on bicycle compatible roadways if mitigated with signing or striping. Typical examples include bridges with narrow widths and sections of roadway that cannot be widened without removing significant street trees. These conditions preferably should not exist for more than a quarter of a mile, or on high speed highways. “Zebra” warning striping should be installed to shift traffic away from the obstacle and allow for a protected buffer for bicycle travel.

In situations where a specific obstacle such as a bridge abutment cannot be avoided, a pavement marking consisting of a single six inch white line starting 20 feet before and offset from the obstacle can also be used to alert cyclists that the travel lane width will soon narrow ahead. (See Section 1003.6 of the Caltrans *Highway Design Manual* for specific instructions.)

In either situation, where bicycle traffic is anticipated, a “SHARE THE ROAD” sign should be used to supplement the warning striping. On longer sections of roadway that are irrevocably narrow, edge striping should be employed to narrow the travel lane and apportion pavement space for a partial shoulder. In situations where even these measures may not provide adequate roadway space for cyclists, it is recommended that an alternate route be designated.

9.2.6 Pavement Design

Though wider tires are now very common and bicycle suspension systems are becoming increasingly prevalent, bicycles still require a riding surface without significant obstacles or pavement defects because they are much more susceptible to such surface irregularities than are motor vehicles. Asphalt is preferred over concrete where shoulders are employed.

The outside pavement area where bicycles normally operate should be free of longitudinal seams. Where transverse expansion joints are necessary on concrete, they should be saw cut to ensure a smooth transition. In areas where asphalt shoulders are added to existing pavement, or where pavement is widened, pavement should be saw cut to produce a tight longitudinal joint to minimize wear and expansion of the joint.

9.2.7 Raised Roadway Markers

Raised roadway markers such as reflectors or rumble strips should not be used on roadway edges where bicycles are most likely to operate because they create a surface irregularity that can be hazardous to bicycle stability. Painted stripes or flexible reflective tabs are preferred. In no case should strips of raised reflectors intended to warn motorists to reduce vehicle speeds prior to intersections be allowed to cross through the bicycle travel lane.

9.2.8 Utilities

Because bicycles are much more sensitive to pavement irregularities than motor vehicles, utility covers should be adjusted as a normal function of any pavement resurfacing or construction operations. Failure to do so can result in the utility cover being sunken below the paving surface level which creates a hazard experienced cyclists refer to as “black holes.” Also, it is common practice to excavate trenches for new utilities at road edges, the same location as bicycle facilities. When such trenching is completed, care should be given to replacing the full surface of the bicycle lane from the road edge to the vehicle travel lane instead of narrow strips that tend to settle or bubble, causing longitudinal obstructions. Replacement of the bike lane striping should also be required.

9.2.9 Drainage Facilities

Storm water drainage facilities and structures are usually located along the edge of roadways where they can present conflicts with cyclists. Careful consideration should be given to the location and design of drainage facilities on roadways with bicycle facilities.

All drainage grate inlets pose some hazard to bicycle traffic. The greatest hazard comes from stream flow drainage grates which can trap the front wheel of a bicycle and cause the cyclist to lose steering control, or allow the narrow bicycle wheels to drop into the grate. Another type of hazard may be caused by cyclists swerving into the lane of traffic to avoid a grate or cover. Riding across any wet metal surface increases the chances of a sudden slip fall.

Only a “bicycle safe” drainage grate with acceptable hydraulic characteristics should be used. The inlet grate should be used in all normal applications and should be installed flush with the final pavement. Where additional drainage inlet capacity is required because of excessive gutter flow or grade (greater than two percent), double inlets should be considered. Depressed grates and stream flow grates should not be used except in unique or unusual situations that require their use and only outside the lane sharing area. Where necessary, depressed grates should only be installed on shoulders six feet wide or greater. Where projects offer the possibility for replacement of stream flow grates located in the lane sharing area, these grates should be replaced with the “bicycle safe” grate.

When roads or intersections are widened, new bicycle safe drainage grates should be installed at a proper location at the outside of the roadway, existing grates and inlet boxes should be removed and the roadway reconstructed. Drainage grate extensions, the installation of steel or iron cover plates or other “quick fix” methods which allow for the retention of the subsurface drain inlet are unacceptable measures since they will create a safety hazard in the portion of the roadway where cyclists operate.

Manholes and covers should be located outside of the lane sharing area wherever possible. Utility fixtures located within the lane sharing area, or any travel lane used by bicycle traffic, should be eliminated or relocated. Where these fixtures cannot be avoided, the utility fixture cover should be made flush with the pavement surface.

9.2.10 Combination Curb and Gutter

These types of curbs reduce space available for cyclists. The width of the gutter pan should not be used when calculating the width of pavement necessary for shared use by cyclist. On steep grades, the gutter should be set back an additional one foot to allow space to avoid high speed crashes caused by the longitudinal joint between the gutter pan and pavement. Where the combination curb and gutter is used, pavement width should be calculated by adding one foot from the curbed gutter.

9.2.11 Bridges

Bridges provide essential crossings over obstacles such as rivers, rail lines and high speed roadways, but they have been almost universally constructed for the expedience of motor vehicle traffic and often have features that are not desirable for bicycling. Among these features are widths that are narrower than the approach roadways (especially when combined with relatively steep approach grades), low railings or parapets, high curbs and expansion joints that can cause steering problems.

Though sidewalks are generally not recommended for cycling, there are limited situations such as long or narrow bridges where designation of the sidewalk as an alternate bikeway facility can be beneficial to cycling, especially when compared to riding in the narrow bridge roadway. This is only recommended where the appropriate curb cuts, ramps and signage can also be included. Using the bridge sidewalk as a bikeway facility is especially useful where pedestrian use is expected to be minimal. Appropriate signage directed to all potential users should be installed so that they will be aware of the shared use situation. Bridge railings or barrier curb parapets where bicycle use is anticipated should be a minimum of 4.5 feet high.

Short of wholesale replacement of existing narrow bridges over rail lines and highways, there are a few measures to substantially improve safety for cyclists. Signage warning motorists of both the presence of cyclists and the minimal bridge width should be installed at the bridge approaches. “Zebra” warning stripe areas should be painted along high curbs to deter cyclists from riding too close to them, which can result in the pedal hitting these high, curbs, causing a crash. This situation is of particular concern since the cyclist will want to stay as far to the right as possible to avoid passing motor vehicles traffic, even though riding far to the right increases the chances of hitting the high curb.

Though the first alternative mentioned above, bridge replacement, is the preferred alternative for bridges that are too narrow, it is the least likely to occur due to cost. A second alternative is to direct cyclists to alternate, safer routes, but this will not always be practical since highway and rail crossing points are usually limited in number and considerable distances apart. In any case, these other crossing points may well have similar width restrictions.

A third alternative is to build separate bridges for cyclist and pedestrian use. Where access warrants a workable solution, this could be a cost-effective long-term solution compared to rebuilding the motor vehicle bridge. These additional bridges could be built adjacent to the motor vehicle bridges, or be installed well away from them, depending upon where best to conveniently accommodate cyclists and pedestrians. An advantage to constructing the bridges away from the motor vehicle bridges is that only one bridge would be needed since building bicycle/pedestrian bridges immediately adjacent to existing motor vehicle bridges would require constructing two one-way spans, one on each side of the roadway, for optimum user safety.

If sidewalk widths are sufficient, directing cyclists to use the sidewalks and installing ramps at the bridge ends is a possible solution. In general, sidewalks are not recommended as a cycling venue and riding on sidewalks is illegal, but in cases where narrow bridges are not expected to be rebuilt for an extended period of time, this may be a reasonable alternative. If possible, a railing should be installed between the roadway and the sidewalk.

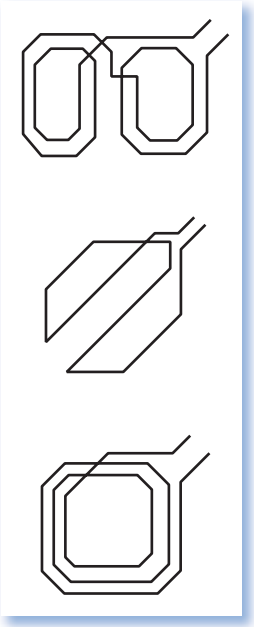
Finally, it should be noted that all the other alternatives are inherently inferior to the first alternative of rebuilding narrow bridges in terms of safety, and should only be considered where the first alternative cannot be implemented.

9.2.12 Traffic Control Devices

As legitimate users of California's roadways, cyclists are subject to essentially the same rights and responsibilities as motorists. In order for cyclists to properly obey traffic control devices, those devices must be selected and installed to take their needs into account. All traffic control devices should be placed so cyclists who are properly positioned on the road can observe them. This includes programmed visibility signal heads.

Traffic Signals and Detectors

Traffic-actuated signals should accommodate bicycle traffic. Detectors for traffic-activated signals should be sensitive to bicycles, should be located in the cyclist's expected path and stenciling should direct the cyclist to the point where the bicycle will be detected. Examples of successful bicycle-sensitive signal detector installation and their specific applications are shown below.



Quadrupole Loop
- Detects most strongly in center
- Sharp cut-off of sensitivity
- Used in bike lanes

Diagonal Quadrupole Loop
- Sensitive over whole area
- Sharp cut-off of sensitivity
- Used in shared lanes

Standard Loop
- Detects strongest over wires
- Gradual cut-off
- Used in advanced detection

Since detectors can fail, added redundancy in the event of failure is recommended in the form of pedestrian push buttons at all signalized intersections. These buttons should be mounted in a location that permits their activation by a cyclist without having to dismount.

It is common for bicycles to be made of so little ferrous metals that they may not be detectable by many currently installed types of loop detectors. As an convenience for cyclists, the strongest loop detection point should be marked with a standard symbol (See Figure 1003.2D: Bike Loop Detector Pavement Marker in Caltrans *Highway Design Manual, Chapter 1000 - Bikeway Planning and Design*).

Where left turn lanes are provided and only protected left turns are allowed, bicycle sensitive loop detectors should be installed in the left turn lane, or a pedestrian style push button should be provided that is accessible to the cyclist in the median immediately adjacent to the turn lane to permit activation of the left turn phase. Where moderate or heavy volumes of bicycle traffic exist, or are anticipated, bicycles should be considered in the timing of the traffic signal cycle as well as in the selection and placement of the traffic detector device. In such cases, short clearance intervals should not be used where cyclists must cross multi-lane streets. According to the 1991 AASHTO *Guide for the Development of Bicycle Facilities*, a

bicycle speed of 10 m.p.h. and a perception/reaction time of 2.5 seconds can be used to check the clearance interval. Where necessary, such as for particularly wide roadways, an all-red clearance interval can be used.

In general, for the sake of cyclist safety, protected left turns are preferred over unprotected left turns. In addition, traffic signal controlled left turns are much safer for cyclists than left turns at which motorists and cyclists must simply yield. This is because motor vehicle drivers, when approaching an unprotected left turn situation or planning to turn left at a yield sign, tend to watch for other motor vehicles and may not see an approaching cyclist. More positive control of left turns gives cyclists an added margin of safety where they need it most.

Signing

When designating a bicycle route, the placement and spacing of signs should be based on the Caltrans *Traffic Manual* and *Highway Design Manual*. For bike route signs to be functional, supplemental plaques can be placed beneath them when located along routes leading to high demand destinations (e.g. "To Downtown," "To Transit Center," etc.) Since bicycle route continuity is important, directional changes should be signed with appropriate arrow sub-plaques. Signing should not end at a barrier. Instead, information directing the cyclist around the barrier should be provided.

According to the *Manual on Uniform Traffic Control Devices (MUTCD)* Part 2A-6: "Care should be taken not to install too many signs. A conservative use of regulatory and warning signs is recommended as these signs, if used to excess, tend to lose their effectiveness. On the other hand, a frequent display of route markers and directional signs to keep the driver informed of his location and his course will not lessen their value."

"BIKE ROUTE" - This sign is intended for use where no unique designation of routes is desired. However, when used alone, this sign conveys very little information. It can be used in connection with supplemental plaques giving destinations and distances. (See Section 1003-3 of the Caltrans *Highway Design Manual* and Part 9B-22 of the *MUTCD* for specific information on sub-plaque options.)

Roadways appropriate for bicycle use, but are undesignated, usually do not require regulatory, guide or informational signing in excess of what is normally required for motorists. In certain situations, however, additional signing may be needed to advise both motorists and cyclists of the shared use of the roadway, including the travel lane.

"SHARE THE ROAD" - This sign is recommended where the following roadway conditions occur:

- Shared lanes (especially if lane widths do not comply with Table 1) with relatively high posted travel speeds of 40 m.p.h. or greater;
- Shared lanes (conforming with Table 1) in areas of limited sight distance;
- Situations where shared lanes or demarcated shoulders or marked bike lanes are dropped or end and bicycle and motor vehicle traffic must begin to share the travel lane;
- Steep descending grades where bicycle traffic may be operating at higher speeds and requires additional maneuvering room to shy away from pavement edge conditions;
- Steep ascending grades, especially where there is no paved shoulder, or the shared lane is not adequately wide and bicycle traffic may require additional maneuvering room to maintain balance at slow operating speeds;
- High volume urban conditions, especially those with travel lanes less than the recommended width for lane sharing;
- Other situations where it is determined to be advisable to alert motorists of the likely presence of bicycle traffic and to alert all traffic of the need to share available roadway space.

9.2.13 Intersections and Driveways

High speed, wide radius intersection designs with free rights turns, multiple right turn lanes, and wide radius turns increase traffic throughput for motor vehicles by minimizing speed differentials between entering and exiting vehicles and through vehicles. However, these designs are dangerous for cyclists (and pedestrians) by design since they exacerbate speed differential problems faced by cyclists traveling along the right side of a roadway and encourage drivers to fail to yield the right-of-way to cyclists. As a result, Caltrans District 11 (San Diego County area) no longer allows such wide radius free right turns at interchanges.

Where they already exist, specific measures should be employed to ensure that the movement of cyclists along the roadway will be visible to motorists and to provide cyclists with a safe area to operate to the left of these wide radius right turn lanes. One method to accomplish this is to stripe (dash) a bicycle lane throughout the intersection area. Also, "SHARE THE ROAD" signs should be posted in advance of the intersection to alert existing traffic. In general, however, curb radii should be limited to short distances, which helps to communicate to the motorist that he or she must yield the right-of-way to cyclists traveling and pedestrians walking along the sidewalk or roadway margin approaching the intersection.

Even so, wherever possible, such intersection conditions should be eliminated. Reconstruction of intersections to accomplish this is a legitimate use of bicycle program funds.

Sand, gravel and other debris in the cyclist's path present potential hazards. In order to minimize the possibility of debris from being drawn onto the pavement surface from unpaved intersecting streets and driveways, during new construction, reconstruction and resurfacing, all unimproved intersecting streets and driveways should be paved back to the right-of-way line or a distance of 10 feet. Where curb cuts permit access to roadways from abutting unpaved parking lots, a paved apron should be paved back to the right-of-way line, preferably 10 feet from the curb line. These practices will lessen the need for maintenance debris removal. The placement of the paved back area or apron should be the responsibility of those requesting permits for access via curb cuts from driveways and parking lots onto the roadway system.

9.2.14 Roadside Obstacles

To make certain that as much of the paved surface as possible is usable by bicycle traffic, obstructions such sign posts, light standards, utility poles and other similar appurtenances should be set back a one foot minimum "shy distance" from the curb or pavement edge with exceptions for guard rail placement in certain instances. Additional separation distance to lateral obstructions is desirable. Where there is currently insufficient width of paved surface to accommodate bicycle traffic, any placement of equipment should be set back far enough to allow room for future projects (widening, resurfacing) to bring the pavement width into conformance with these guidelines. Vertical clearance to obstructions should be a minimum of 8 feet, 6 inches. (See Section 1003.1 of the Caltrans Highway Design Manual.)

9.2.15 Railroad Crossings

As with other surface irregularities, railroad grade crossings are a potential hazard to bicycle traffic. To minimize this hazard, railroad grade crossings should, ideally, be at a right angle to the rails. This minimizes the possibility of a cyclist's wheels being trapped in the rail flangeway, causing loss of control. Where this is not feasible, the shoulder (or wide outside lane) should be widened, or "bumped out" to permit cyclists to cross at right angles. (See Section 1003.6 of the Caltrans Highway Design Manual.)

It is important that the railroad grade crossing be as smooth as possible and that pavement surfaces adjacent to the rail be at the same elevation as the rail. Pavement should be maintained so that ridge buildup does not occur next to the rails.

Options to provide a smooth grade crossing include removal of abandoned tracks, use of compressible flangeway fillers, timber plank crossings or rubber grade crossing systems. These improvements should be included in any applicable project.

9.2.16 TSM Type Improvements

Transportation Systems Management (TSM) improvements are minor roadway improvements which enhance motor vehicle flow and capacity. They include intersection improvements, channelization, addition of auxiliary lanes, turning lanes and climbing lanes. TSM improvements must consider the needs of bicycle traffic in their design, or they may seriously degrade the ability of the roadway to safely accommodate cyclists. The inclusion of wider travel lanes or adjacent bike lanes will decrease traffic conflicts and increase vehicular flow. Designs should provide for bicycle compatible lanes or paved shoulders. Generally, this requires that the outside through lane and (if provided) turning lane be 14 feet wide. Auxiliary or climbing lanes should conform to Table 1 by either providing an adjacent paved shoulder, or a shared lane width of at least 15 feet. Where shared lanes and shoulders are not provided, it must be assumed that bicycle traffic will take the lane.

9.2.17 Marginal Improvements and Retrofitting Existing Roadways

There may be instances or locations where it is not feasible to fully implement guidelines pertaining to the provision of adequate pavement space for shared use due to environmental constraints or unavoidable obstacles. In such cases, warning signs and/or pavement striping must be employed to alert cyclists and motorists of the obstruction, alert motorists and cyclist of the need to share available pavement space, identify alternate routes (if they exist), or otherwise mitigate the obstruction.

On stretches of roadway where it is not possible to provide recommended shoulder or lane widths to accommodate shared use, bicycle traffic conditions can be improved by:

- Striping wider outside lanes and narrower interior lanes; or

- Providing a limited paved shoulder area by striping a narrow travel lane. This tends to slow motor vehicle operating speeds and establish a space (with attendant psychological benefits) for bicycle operation.

Where narrow bridges create a constriction, “zebra“ striping should be used to shift traffic away from the parapet and provide space for bicycle traffic.

Other possible strategies include:

- Elimination of parking or restricting it to one side of the roadway;
- Reduction of travel lanes from two in each direction to one in each direction plus center turn lane and shoulders; or
- Reduction of the number of travel lanes in each direction and the inclusion or establishment of paved shoulders.

9.2.18 Access Control

Frequent access driveways, especially commercial access driveways, tend to convert the right lane of a roadway and its shoulder area into an extended auxiliary acceleration and deceleration lane. Frequent turning movements, merging movements and vehicle occupancy of the shoulder can severely limit the ability of cyclists to utilize the roadway and are the primary causes of motor vehicle-bicycle collisions. As a result, access control measures should be employed to minimize the number of entrances and exits onto roadways. For driveways having a wide curb radius, consideration should be given to marking a bicycle lane through the driveway intersection areas. As with other types of street intersections, driveways should be designed with sufficiently tight curb radii to clearly communicate to motorists that they must fully stop and then yield the right-of-way to cyclists and pedestrians on the roadway.

9.2.19 Bikeway Reconstruction after Construction

Since roadways with designated bicycle facilities carry the largest volumes of users, their reconstruction should be of particular concern. Unfortunately, bicycle facilities are often installed piecemeal and users can find themselves facing construction detours and poor integration of facilities where the facilities begin and end.

Bicycles facilities also sometimes seem to “disappear” after roadway construction occurs. This can happen incrementally as paving repairs are made over time and are not followed by proper bikeway re-striping. When combined with poor surface reconstruction following long periods out of service due to road work, this can result in the eventual loss of affected bikeway facilities and decrease the number of cyclists regularly using the facilities.

Adjacent construction projects that require the demolition and rebuilding of roadway surfaces can cause problems in maintaining and restoring bikeway function. Construction activities controlled through the issuance of permits, especially driveway, drainage, utility, or street opening permits, can have an important effect on the quality of a roadway surface where cyclists operate. Such construction can create hazards such as mismatched pavement heights, rough surfaces or longitudinal gaps in adjoining pavements, or other pavement irregularities.

Permit conditions should ensure that pavement foundation and surface treatments are restored to their pre-construction conditions, that no vertical irregularities will result and that no longitudinal cracks will develop. Stricter specifications, standards and inspections designed to prevent these problems should be developed, as well as more effective control of construction activities wherever bikeways must be temporarily demolished. A five-year bond should be held to assure correction of any deterioration, which might occur as a result of faulty reconstruction of the roadway surface.

Spot widening associated with new access driveways frequently results in the relocation of drainage grates. Any such relocation should be designed to permanently close the old drainage structure and restore the roadway surface. New drainage structures should be selected and located to comply with drainage provisions established in these guidelines.

9.2.20 Maintenance Priorities

Bikeway maintenance is easily overlooked. The “sweeping” effect of passing motor vehicle traffic readily pushes debris such as litter and broken glass toward the roadway edges where it can accumulate within an adjoining bicycle facility. Since the potential for loss of control can exist due to a blowout caused by broken glass, or through swerving to avoid other debris, proper maintenance is directly related to safety. For this reason, street sweeping must be a priority on roadways with bike facilities, especially in the curb lanes and along the curbs themselves. The police department could assist by requiring towing companies to fully clean up crash scene debris, or face a fine. This would prevent glass and debris from being left in place after a motor vehicle crash, or simply swept to the curb or shoulder area.

A suggested minimum monthly sweeping schedule is recommended for heavily used Class 1 and 2 facilities, and twice a year where use is light. Class 3 facilities should be swept twice a year.

The availability of a forum through which citizens can conveniently notify the proper city authority of bikeway facility problems or shortcomings is desirable. Several local cities make available a service request form via their Internet home pages to allow citizens to report problems such as streets, sidewalks, tree trimming and other civil engineering and infrastructural issues. They generally do not mention bicycle facilities specifically in their list of selected problems, but do offer the user the opportunity to type in the particulars of any street-related issue.

9.2.21 Intermodal Planning and Facilities

Creating an environment conducive to intermodal transit begins with providing the proper types of facilities and amenities in locations convenient enough to attract potential users. Such facilities can include those described in the following sections.

Bike Lockers and Racks

The provision of bicycle racks and lockers is an important first step in making a multi-modal system work for cyclists. Their presence encourages cyclists to use available transit because these facilities help to alleviate concerns about security, primarily theft or vandalism of bicycles parked for long periods.

Bus-mounted Racks

The provision of bus-mounted bicycle racks on bus routes should encourage cyclists to use the bus system, especially in the eastern sections of the City where topography is the most pronounced. These racks are mounted on the front of the bus to increase visibility between the bus driver and the cyclist using the rack and to decrease the chance of theft while the bus is stopped.

9.2.22 Traffic Calming

There exist roadway conditions in practically all communities where controlling traffic movements and reducing motor vehicle speeds is a worthwhile way to create a safer and less stressful environment for the benefit of non-motorized users such as pedestrians and cyclists. These controlling measures are referred to as traffic calming. These measures are also intended to mitigate impacts of vehicular traffic such as noise, crashes and air pollution, but the primary link between traffic calming and bicycle planning is the relationship between motor vehicle speed and the severity of crashes. European studies have shown that instituting traffic calming techniques significantly decreases the number of pedestrian and cyclist fatalities in crashes involving motor vehicles, as well as the level of injuries and air pollution, without decreasing traffic volume.

Stop Signs/Yield Signs

The installation of stop signs is a common traffic calming device intended to discourage vehicular through traffic by making the route slower for motorists. However, stop signs are not speed control devices, but rather right-of-way control devices. They do not slow the moving speed of motor vehicles and compliance by cyclists is very low. Requiring motor vehicles to stop excessively also contributes to air pollution. Cyclists are even more inconvenienced by stop signs than motorists because unnecessary stopping requires them to repeatedly reestablish forward momentum. The use of stop signs as a traffic management tool is not generally recommended unless a bicycle route must intersect streets with high motor vehicle traffic volumes. Controlled intersections generally facilitate bicycle use and improve safety and stop signs tend to facilitate bicycle movement across streets with heavy motor vehicular traffic. An alternative to stop signs may be to use yield signs or other traffic calming devices as methods to increase motorist awareness of crossing cyclists.

Speed Bumps and Tables

Though many cities are no longer installing speed bumps, they have been shown to slow motor vehicle traffic speeds and reduce volume. If speed bumps are employed as a traffic management tool, a sufficiently wide gap must be provided to allow unimpeded bicycle travel around the bump to prevent safety hazards for cyclists. Standard advance warning signs and markers must be installed as well.

Partial Traffic Diverters

These traffic calming devices include roundabouts and chicanes, both of which force traffic to follow a curved path, which had formerly been straight. They are usually employed in areas of traditional grid street configuration. These devices can actually increase traffic hazards if they are not substantial enough to decrease motor vehicle speeds, or if appropriate side street access points are not controlled.

Total Traffic Diverters

These diverters close roadways to motor vehicles only, or divert them to other routes while continuing to provide access to non-motorized users. Partial diverters allow access for cyclists in both directions, but block motor vehicle entry at one end. Both devices reduce motor vehicle driver options as a means to reduce the local traffic volume while allowing unrestricted access for pedestrians and cyclists. They are only useful where bicycles are fully exempt from the restrictions preventing the access of motor vehicles. Bicycle access should be clearly signed where motor vehicle access is limited so that cyclists are made aware that they can proceed even though motor vehicles cannot.

Curb Extensions and Radius Reductions

Larger curb radii are intended to facilitate high speed right-turn movements for the convenience of motorists. However, these larger radii are more dangerous for crossing and adjacent cyclists and pedestrians both because of the resulting higher motor vehicle speeds and the longer crossing distance for the cyclists and pedestrians. Motorists tend to spend less time looking for pedestrians and cyclists when they are attempting to make a high speed turn because their attention is focused on watching for oncoming traffic from the left. Their tendency to watch for pedestrians crossing from the right is also reduced. In addition, this type of intersection encourages higher speed movements across the bicycle travel lane, increasing the risk of collisions. To avoid these problems, curb radii should be reduced and curb extensions installed that pinch in toward the motor vehicle traffic lanes. This narrowing of the roadway tends to reduce traffic speeds, which creates a longer period for drivers to see potential conflicts before making right turns. However, due to the resulting reductions in motor vehicle speeds, this approach may not be appropriate at congested intersections. In such cases, there should instead be a safe lane and crossover segment especially for cyclists.

Extensions are curb bulbs extending into the intersection from the corners of one or both of the intersecting roadways. Reducing curb radii functionally narrows the intersection, shortening the crossing distance for pedestrians and cyclists and slowing approaching traffic. Curb extensions are even more effective than reduced curb radii in decreasing crossing distance and slowing traffic. They can also serve the additional purposes of defining parking lanes and improving visibility at corners.

The use of curb extensions should be confined to residential areas and commercial zones with moderate posted speed limits since they prevent the use of the curb lane for cycling in favor of vehicular parking. Reduced curb radii can be used more widely, or on streets with routine large truck use requiring right turns.

9.3 Class 1 Multi-Use Path Guidelines

Class 1 facilities are generally paved multi-use paths, separated from motor vehicle traffic. Off-street routes are rarely constructed for the exclusive use of cyclists since other non-motorized user types will also find such facilities attractive. For that reason, the facilities recommended in this master plan should be considered multi-use where cyclists will share the pathways with other users. Recommended Class 1 paths are intended to provide commuting and recreational routes unimpeded by motor vehicle traffic.

No matter what their primary focus, most cyclists will find bicycle paths inviting routes to ride, especially if travel efficiency is secondary to enjoyment of cycling. Since these paths can augment the existing roadway system, they can extend circulation options for cyclists, making trips feasible which would not otherwise be possible if the cyclists had to depend exclusively on roadways, especially in areas where usable roads are limited. Class B and C (casual riders and children) cyclists would likely also appreciate the relative freedom from conflicts with motor vehicles compared to riding on typical roadways.

By law, the presence of a Class 1 route near an existing roadway does not justify prohibiting bicycles on the parallel or nearly parallel roadway. Where a bikeway master plan calls for

Class 1 routes parallel to the alignments of planned roadways, these roadways should still be designed to be compatible with bicycle use. Two reasons to retain parallel facilities are that an experienced cyclist may find Class 1 paths inappropriate because of intensive use, or the routes may not be direct enough. By the same token, the Class 1 path will likely be much more attractive to less experienced cyclists than a parallel facility on the street.

In general, Class 1 facilities should not be placed immediately adjacent to roadways. Where such conditions exist, Class 1 facilities should be offset from the street as much as possible and separated from it by a physical barrier. These measures are intended to promote safety for both the cyclists and the motorists by preventing unintended movement between the street and the Class 1 facility. (See Section 1003.1 (5) of the Caltrans Highway Design Manual.)

9.3.1 Class 1 Planning Issues Shared-Use of Multiple Use Paths

Since off-street paths (Class 1) are now generally regarded as multi-use and not for the exclusive use of cyclists, they must be designed for the safety of both cyclists and other expected user types. Heavy use of multi-use trails can create conflicts between different types of users. These conflicts can include speed differentials between inexperienced and experienced cyclists as well as between pedestrians, joggers and in-line skaters, differences in the movements typical of particular user types and even the kinds of groupings common to the different user types as they casually move down the pathway.

As long as volumes are low, the level of conflict between different user types can be managed without enforcement. However, even moderate increases in user volume can create substantial deterioration in level of service and safety. Conflicts between different user types are especially likely to occur on regionally significant recreational trails that attract a broad diversity of users, such as the Bayshore Bikeway. In general, paths that are expected to receive heavy use should be a minimum of 14 feet wide, paths expected to experience moderate use should be at least 12 feet wide and low volume paths can be 10 feet wide. Caltrans Class 1 requirements call for eight feet (2.4 meters) as the minimum width with two-foot (0.6 meters) clear areas on each side.

Regulation of Multiple Use Paths

The potential for multiple-use path conflicts has increased substantially in recent years with the increased popularity of jogging and in-line skating. Where multi-use paths were once commonly used primarily by pedestrians and secondarily by cyclists, today they tend to be used by a combination of pedestrians, cyclists and in-line skaters. In-line skating continues to be one of the fastest growing sport in America. Also, the majority of bicycles sold in the United States over the last decade have been mountain and “comfort” bikes, far outstripping sales of drop-bar type road bike sales. These bikes’ relative comfort and upright riding position have helped to encourage inexperienced cyclists who previously rarely rode to do so more often.

Methods used to reduce trail conflicts have included providing separate facilities for different groups, prohibiting certain user types, restricting certain uses to specific hours, widening existing facilities or marking lanes to regulate traffic flow. Examples of all of these types of actions occur along southern California’s coastal trails where conflicts between different user types can be especially severe during peak periods.

Compatibility of Multiple Use of Paths

Joint use of paths by cyclists and equestrians can pose problems due to the ease with which horses can be startled. Also, the requirements of a Class 1 bikeway facility include a solid surface, which is not desirable for horses. Therefore, where either equestrian or cycling activity is expected to be high, separate trails are recommended. On facilities where Class 1 designation is not needed and the facility will be unpaved, mountain bikes and horses can share the trail if adequate passing width is provided, the expected volume of traffic by

both groups is low and available sight distances allow equestrians and cyclists to see and anticipate each other. Education of all path users in "trail etiquette" has also proven to be successful on shared paths.

Urban Access Pathways

Conflicts between different user types on multiple use routes occur primarily on heavily used recreational paths, or near major pedestrian trip generators. Lightly used neighborhood pathways and community trails can be safely shared by a variety of user types. Construction of urban access pathways between adjoining residential developments, schools, neighborhoods and surrounding streets can substantially expand the circulation opportunities for both pedestrians and cyclists.

However, bicycle use of urban access pathways should not include sidewalks adjacent to streets for a number of reasons. First, sidewalks are designed for pedestrian speeds and maneuverability. Second, they are usually encumbered by parking meters, utility poles, benches, trees, etc. Third, other types of users and their specific types of maneuverability can also pose a safety issue for cyclists.

Though sidewalks are, in general, not conducive to safe cycling, an exception is Class C cyclists, young children. This type of bicycle use is generally acceptable because it provides young children who do not yet have the judgment or skill to ride in the street an opportunity to develop their riding skills. Sidewalks in residential areas generally have low pedestrian volumes and are usually accepted as play areas for children.

Finally, one other exception to sidewalk use by cyclists should be allowed. This is where the walkway is at least eight feet wide and well away from streets, such as within parks. In such cases, bicycle use on walkways can occur safely.

Bicycle Paths Adjacent to Roadways

Two-way bicycle facilities located immediately adjacent to a roadway are not recommended because they require one direction of bicycle traffic to ride against motor vehicle traffic, contrary to the normal "Rules of the Road." This puts the wrong way cyclists in the motorists' "blind spot" at intersections where they do not have the right-of-way, or are not noticed by motorists turning right because the cyclists are not on the roadway. Many cyclists will also find it less convenient to ride on this type of facility as compared to streets, especially for utility trips such as commuting. This more experienced group of cyclists may find the roadway more efficient, safer, or better maintained than the adjacent bicycle facility. The AASHTO guide states that: "...bicycle lanes, or shared roadways should generally be used to accommodate bicycle traffic along highway corridors rather than providing a bicycle path immediately adjacent to the highway."

9.4 Design of Class 1 Facilities (Paths Primarily Used by Bicycles)

A substantial portion of the following sections is taken directly from the *AASHTO Guide for the Development of Bicycle Facilities*, 1991. Note that AASHTO's use of the term "bicycle path" is equivalent to a "Class 1 bicycle facility" as defined by Caltrans and as used in this master plan. Also, the AASHTO term "highway" is synonymous with the term "roadway." Finally, all measurements in the Caltrans documents are in metric form.

9.4.1 Width and Clearance

The paved width and the operating width required for a bicycle path are primary design considerations. Under most conditions, recommended paved width for a two-directional bicycle path is 10 feet. In some instances, however, a minimum of eight feet can be adequate. This minimum should be used only where the following conditions prevail: (1) bicycle traffic is expected to be low, even on peak days or during peak hours; (2) pedestrian use of the facility is not expected to be more than occasional; (3) there will be good horizontal and vertical alignment providing safe and frequent passing opportunities; and (4) the path will

not be subject to maintenance vehicle loading conditions that would cause pavement edge damage. Under certain conditions, it may be necessary or desirable to increase the width of bicycle path to 12 feet or more, for example, because of substantial bicycle volume, probable shared use with joggers and other pedestrians, use by large maintenance vehicles, steep grades, or where bicycles will be likely to ride two abreast.

Reduced widths are acceptable on access pathways due to their generally short length and low volumes. However, wherever possible, minimum width standards should be employed. One-directional bicycle facilities are not generally recommended since they will almost certainly be used as two-way facilities.

A minimum of a two foot wide graded area should be maintained adjacent to both sides of the pavement. However, three feet or more is desirable to provide clearance from trees, poles, walls, fences, guardrails, or other lateral guidelines. A wider graded area on either side of the bicycle path can also serve as a separate jogging or equestrian path. Vertical clearance from obstructions should be a minimum of eight feet. However, greater vertical clearance may needed to permit maintenance vehicle passage and, in undercrossings and tunnels, a clearance of 10 feet is desirable for adequate vertical shy distance.

9.4.2 Horizontal Separation from Roadways

Class 1 bicycle facilities are generally physically separated from roadways. However, where a Class 1 facility must be considered within a roadway right-of-way, a wide separation between a bicycle path and adjacent highway is desirable to confirm for both the cyclist and the motorist that the bicycle path functions as an independent highway for bicycle traffic. In addition to physical separation, landscaping or other visual buffer is desirable. When this is not possible and the distance between the edge of the roadway and the bicycle path is less than five feet, a suitable physical divider may be considered. Such dividers serve both to prevent cyclists from making unwanted movements between the path and the highway shoulder for the protection of cyclists from motor vehicles and to reinforce the concept that the bicycle path is an independent facility. Where used, the divider should be a minimum of 4.5 feet high to prevent cyclists from toppling over it and it should be designed so that it does not become an obstruction or traffic hazard in itself.

9.4.3 Design Speed

The speed that a cyclist travels is dependent on several factors, including the type and condition of the bicycle, the purpose of the trip, the condition and location of the bicycle path, the speed and direction of the wind and the physical condition of the cyclist. Bicycle paths should be designed for a selected speed that is at least as high as the preferred speed of the faster cyclists. In general, a minimum design speed of 20 m.p.h. should be used. However, when the grade exceeds four percent, a design speed of 30 m.p.h. is advisable.

On unpaved paths, where cyclists tend to ride slower, a lower design speed of 15 m.p.h. can be used. Similarly, where the grades dictate, a higher design speed of 25 m.p.h. can be used. Since bicycles have a higher tendency to skid on unpaved surfaces, horizontal curvature design should take into account lower coefficients of friction.

9.4.4 Horizontal Alignment and Superelevation

The minimum radius of curvature negotiable by a bicycle is a function of the superelevation rate of the bicycle path surface, the coefficient of friction between the bicycle tires and the bicycle path surface and the speed of the bicycle. The minimum design radius of curvature can be derived from the following formula:

$$R = \frac{V^2}{127\left(\frac{e}{100} + f\right)}$$

R = Minimum radius of curvature (meters)
V= Design speed (k.p.h.)
e = Rate of superelevation
f = Coefficient of friction

For most bicycle path applications, the superelevation rate will vary from a minimum of two percent (the minimum necessary to encourage adequate drainage) to a maximum of approximately five percent (beyond which maneuvering difficulties by slow bicycles and adult tricyclists might be expected). The minimum superelevation rate of two percent will be adequate for most conditions and will simplify construction.

The coefficient of friction depends upon speed; surface type, roughness and condition; tire type and condition; and whether the surface is wet or dry. Friction factors used for design should be selected based upon the point at which centrifugal force causes the cyclist to recognize a feeling of discomfort and instinctively act to avoid higher speed. Extrapolating from values used in highway design, design factors for paved bicycle paths can be assumed to vary from 0.30 at 15 m.p.h. to 0.22 at 30 m.p.h. Based on a superelevation rate (e) of two percent, minimum radii of curvature can be selected from Figure 1003.1C of the Caltrans *Highway Design Manual*.

When substandard radius curves must be used on bicycle paths because of right-of-way, topography, or other considerations, standard curve warning signs and supplemental pavement markings should be installed in accordance with the Caltrans Highway Design Manual. The negative effects of substandard curves can also be partially offset by widening the pavement through the curves.

9.4.5 Grade

Grades on bicycle paths should be kept to a minimum, especially on long inclines. Grades greater than five percent are undesirable because the ascents are difficult for many cyclists and the descents cause some cyclists to exceed the speeds at which they are competent. Where terrain dictates, grades over five percent and less than 500 feet long are acceptable when a higher design speed is used and additional width is provided.

9.4.6 Switchbacks

In areas of steep terrain, a series of “switchbacks” may be the only solution to traversing changes in elevation. At these locations, a grade of eight percent is acceptable for a distance of no more than 100 feet. Where applicable, grades steeper than eight percent will not meet Americans with Disabilities Act (ADA) standards. Switchback radii should be larger than normally employed for pedestrian facilities to allow for cyclists to be able to safely make the turns without having to dismount. Pavement width should be a minimum of 12 feet wide to allow ascending cyclists room to walk their bicycles when necessary. The switchbacks should be completely visible from the next uphill turn. Runouts at the end of each turn should be considered for cyclists unable to slow down quickly enough to make the turn. Railings may installed to discourage shortcuts and appropriate signing should be placed at the top of the descent.

9.4.7 Sight Distances

To provide cyclists with an opportunity to see and react to the unexpected, a bicycle path should be designed with adequate stopping sight distance. The distance required to bring a bicycle to a full controlled stop is a function of the cyclist’s perception and brake reaction time, the initial speed of the bicycle, the coefficient of friction between the tires and the pavement and the braking ability of the bicycle. Figure 1003.1D of the Caltrans *Highway Design Manual* indicates the minimum stopping sight distance for various design speeds and grades based on a coefficient of 0.25 to account for the poor wet weather braking characteristics of many bicycles. For two-way bicycle paths, the sight distance in descending direction, that is, where “G” is negative, will control the design.

9.4.8 Intersections

Intersections with roadways are important considerations in bicycle path design. If alternate locations for a bicycle path are available, the one with the most favorable intersection conditions should be selected. For crossings of freeways and other high-speed, high-volume arterials, a grade separation structure may be the only possible or practical treatment. Unless

bicycles are prohibited from the crossing highway, providing for turning movements must be considered. When intersections occur at grade, a major consideration is the establishment of right-of-way. The type of traffic control (signal, stop sign, yield sign, etc.) to be used and locations should be provided in accordance with the Caltrans *Traffic Manual*.

Sign type, size and location should also be in accordance with the Caltrans *Traffic Manual*. Care should be taken to ensure that bicycle path signs are located so that motorists are not confused by them and that roadway signs are placed so that they do not confuse cyclists. Other means of alerting cyclists of a highway crossing include lateral deflections or small vertical deflections, as well as changing the paving surface at the approach. Devices installed to prohibit motorists from entering the bike path can also assist with alerting cyclists to crossings, but they must be well marked, including with reflective markings.

It is preferable that the crossing of a bicycle path and a highway be at a location away from the influence of intersections with other highways. Controlling vehicle movements at such intersections is more easily and safely accomplished through the application of standard traffic control devices and normal "Rules of the Road." Where physical constraints prohibit such independent intersections, the crossings may be at or adjacent to the pedestrian crossing. Right-of-way should be assigned and sight distance should be provided so as to minimize the potential for conflict resulting from unconventional turning movements. At crossings of high volume multi-lane arterial highways where signals are not warranted, consideration should be given to providing a median refuge area for cyclists.

The entrances to Class 1 paths can sometimes create crossing conflicts. Methods to resolve this include signalized striped crosswalks with pedestrian push-buttons, bicycle loop detectors and pavement logos, bicycle signal heads, in-pavement flashing lights at unsignalized intersections, and various traffic calming techniques. Bollards should also be placed at the entrance to the path to keep vehicles from entering.

When bicycle paths terminate at existing roads, it is important to integrate the path into the existing system of roadways. Care should be taken to properly design the terminals to transition the traffic into a safe merging or diverging situation. Appropriate signing is necessary to warn and direct both cyclists and motorists regarding these transition areas.

Bicycle path intersections and approaches should be on relatively flat grades. Stopping sight distances at intersections should be checked and adequate warning should be given to permit cyclists to stop before reaching the intersection, especially on downgrades.

Ramps for curb cuts at intersections should be the same width as the bicycle paths. Curb cuts and ramps should provide a smooth transition between the bicycle paths and the roadway.

9.4.9 Signing and Marking

Adequate signing and marking are essential on bicycle paths, especially to alert cyclists to potential conflicts and to convey regulatory messages to both cyclists and motorists at highway intersections. In addition, guide signing, such as to indicate directions, destinations, distance, route numbers and names of crossing streets, should be used in the same manner as they are used on highways. In general, uniform application of traffic control devices, as described in the Caltrans Highway *Design and Traffic Manuals*, will tend to encourage proper cyclist behavior.

A designer should consider a four-inch wide yellow centerline stripe to separate opposite directions of travel if heavy volumes of bicycles are expected, on curves with restricted sight distances; and on unlighted paths where nighttime riding is expected. Edge lines can also be very beneficial where significant nighttime bicycle traffic is expected.

General guidance on signing and marking is provided in the Caltrans *Highway Design Manual*. Care should be exercised in the choice of pavement marking materials. Some marking materials are slippery when wet and should be avoided in favor of more skid-resistant materials.

9.4.10 Pavement Structure

Under most circumstances, a two-inch thick asphalt top course placed on a six-inch thick select granular sub-base is suitable for a bikeway pavement structure. Where unsatisfactory soils can be anticipated, a soil investigation should be conducted to determine the load-carrying capabilities of the native soil and the need for any special provisions.

In addition, some basic differences between the operating characteristics of bicycles and those of motor vehicles should be recognized. While loads on bicycle paths will be substantially less that typical roadway loads, paths should be designed to sustain without damage the wheel loads of occasional emergency, patrol, maintenance and other motor vehicles that are expected to use or cross the path. Where such motor vehicle use will be required, four inches of asphalt should be used. Additional pavement structure may also be necessary in flood plains and in locations where shallow root systems may heave thin pavement sections.

Special consideration should be given to the location of motor vehicle wheel loads on the path. When motor vehicles are driven on bicycle paths, their wheels will usually be at or very near the edges of the path. Since this can cause edge damage that, in turn, will result in the lowering of the effective operating width of the path, adequate edge support should be provided. Edge support can be either in the form of stabilized shoulders or in constructing additional pavement width. Constructing a typical pavement width of 12 feet, where right-of-way and other conditions permit, eliminates the edge-raveling problem and offers two other additional advantages over shoulder construction. First, it allows additional maneuvering space for cyclists and second, the additional construction cost can be less than that for constructing shoulders because the separate construction operation is eliminated.

It is important to construct and maintain a smooth riding surface on bicycle paths. Bicycle path pavements should be machine laid. Root barriers should be used where necessary to prevent vegetation from rupturing the pavement over time, and on Portland cement concrete pavements, transverse joints, necessary to control cracking, should be saw cut to provide a smooth ride. On the other hand, skid resistance qualities should not be sacrificed for the sake of smoothness. Broom finish or burlap drag concrete surfaces are preferred over trowel finishes, for example.

At unpaved highway or driveway crossings of bicycle paths, the highway or driveway should be paved a minimum of 10 feet on each side of the crossing to reduce the amount of gravel being scattered along the path by motor vehicles. The pavement structure at the crossing should be adequate to sustain the expected loading at the location.

9.4.11 Structures

An overpass, underpass, small bridge, drainage facility or facility on a highway bridge may be necessary to provide continuity to a bicycle path. On new structures, the minimum clear width should be the same as the approach paved bicycle path and the desirable clear width should include the minimum two-foot wide clear areas. Carrying the clear areas across the structures has two advantages. First, it provides a minimum horizontal shy distance from the railing or barrier, and second, it provides needed maneuvering space to avoid conflicts with pedestrians and other cyclists who are stopped on the bridge. Access by emergency, patrol and maintenance vehicles should be considered in establishing the design clearances of structures on bicycle paths. Similarly, vertical clearance may be dictated by occasional motor vehicles using the path. Where practical, a vertical clearance of 10 feet is desirable for adequate vertical shy distance.

Railings, fences, or barriers on both sides of a bicycle path structure should be a minimum of 4.5 feet high. Smooth rub rails should be attached to the barriers at handlebar height of 3.5 feet.

Bridges designed exclusively for bicycle traffic may be designed for pedestrian live loading. On all bridge decks, special care should be taken to ensure that bicycle safe expansion joints are used.

Where it is necessary to retrofit a bicycle path onto an existing highway bridge, several alternatives should be considered in light of what the geometrics of the bridge will allow.

One option is to carry the bicycle path across the bridge on one side. This should be done where the bridge facility will connect to a bicycle path at both ends, sufficient width exists on that side of the bridge, or can be obtained by widening or re-striping lanes; and provisions are made to physically separate bicycle traffic from motor vehicle traffic as discussed above.

A second option is to provide either wide curb lanes or bicycle lanes over the bridge. This may be advisable where the bicycle path transitions into bicycle lanes at one end of the bridge; and sufficient width exists, or can be obtained by widening or re-striping.

A third option is to use existing sidewalks as one-way or two-way facilities. This may be advisable where conflicts between cyclists and pedestrians will not exceed tolerable limits, and the existing sidewalks are adequately wide. Under certain conditions, the cyclist may be required to dismount and cross the structure as a pedestrian.

Because of the large number of variables involved in retrofitting bicycle facilities onto existing bridges, compromises in desirable design criteria are often inevitable. Therefore, the width to be provided is best determined by the designer, on a case-by-case basis, after thoroughly considering all the variables.

9.4.12 Drainage

The recommended minimum pavement cross slope of two percent adequately provides for drainage. Sloping in one direction instead of crowning is preferred and usually simplifies the drainage and surface construction. A smooth surface is essential to prevent water ponding and ice formation.

Where a bicycle path is constructed on the side of a hill, a ditch of suitable dimensions should be placed on the uphill side to intercept the hillside drainage. Such ditches should be designed in such a way that no undue obstacles are presented to cyclists. Where necessary, catch basins with drains should be provided to carry the intercepted water under the path. Drainage grates and manhole covers should be located outside of the travel path of the cyclist. (See Section 1003.6 of the Caltrans *Highway Design Manual*.) To assist in draining the area adjacent to the bicycle path, the design should include considerations for preserving the natural ground cover. Seeding, mulching and sodding of adjacent slopes, swales and other erosion-prone areas should be included in the design plans.

9.4.13 Lighting

Lighting is encouraged for both guidance and safety reasons and should be considered along Class 1 paths especially if heavy use is expected in the evening hours. Applicable situations include bicycle paths serving colleges or employment centers, as well as at highway intersections. Lighting should also be considered through underpasses or tunnels and when nighttime security could be a problem. Fixed-source lighting reduces conflicts along the paths and at intersections. In addition, lighting allows the cyclist to see the bicycle path direction, surface conditions and obstacles.

Depending on the location, average maintained horizontal illumination levels of 5 to 22 lux should be considered. Light standards (poles) should meet the recommended horizontal and vertical clearances. Luminaires and standards should be at a scale appropriate for a pedestrian or bicycle path. (See Section 1003.6 of the Caltrans *Highway Design Manual*.)

9.4.14 Barriers to Motor Vehicle Traffic

Bicycle paths often need some type of physical barrier at highway intersections and pedestrian-load bridges to prevent unauthorized motor vehicles from using the facilities. Provisions can be made for a lockable, removable post to permit entrance by authorized vehicles. The post should be permanently reflectorized for nighttime visibility and painted a bright color for improved daytime visibility. When more than one post is used, a five foot spacing is desirable. Wider spacing can allow entry to motor vehicles, while narrower spacing might prevent entry by adult tricycles and bicycles with trailers. Striping an envelope around the barrier is recommended. (See Section 1003.1 of the Caltrans *Highway Design Manual.*)

An alternate method of restricting entry of motor vehicles is to split the entryway into two five-foot sections separated by low landscaping. Emergency vehicles can still enter if necessary by straddling the landscape. The maintenance costs associated with landscaping should be acknowledged, however, before this alternative method is selected.

9.5 Unpaved Multi-Use Facilities

In some cases, unpaved trails or roads may be used as part of a bikeway system. Though not eligible for official designation as bicycle facilities, they can be acknowledged as “informal” unpaved connections between official paved segments. Because these routes are generally in less developed areas, they may also be considered scenic unpaved “byways” that can be accessed via the official bikeway system.

Many of the bicycles sold are mountain bikes designed for use on unpaved surfaces and come equipped with wide tires and low gearing. Many recreational cyclists ride this type of bicycle and may use them on a well maintained unpaved route. Unpaved routes are unlikely to attract many commuting cyclists, but the routes may experience some utility use if they provide convenient shortcuts between popular destinations where such routes would not otherwise exist.

Available guidelines for unpaved facilities are limited. In general, the coefficient of friction used in calculating curve radii and a factor in determining design speed, should be reduced. Although there are not data available for unpaved surfaces, it is suggested that friction factors be reduced by 50 percent to allow a sufficient margin of safety. This reduction in friction affects all situations where traction is important, especially on grades. Grades steeper than three percent may not be practical for bicycle paths with crushed stone surfaces.

In cases where switchbacks are necessary for unpaved paths that occur in steep terrain, curve radii may be enlarged, the path widened and runout areas provided. In areas of erosive soils, it is also advisable to install signage suggesting cyclists dismount when traversing the switchbacks.

9.6 Class 2 Facilities

Class 2 facilities are marked bicycle lanes within roadways usually adjacent to the curb lane, delineated by appropriate striping and signage.

Bicycle lanes can be considered when it is desirable to delineate available road space for preferential use by cyclists and motorists and to provide for more predictable movements by each. Bicycle lane markings can increase a cyclist’s confidence in motorists not straying into his/her path of travel. Likewise, passing motorists are less likely to swerve to the left out of their lane to avoid cyclists on their right.

Bicycle lanes should always be one-way facilities and carry traffic in the same direction as adjacent motor vehicle traffic. Two-way bicycle lanes on one side of the roadway are unacceptable because they promote riding against the flow of motor vehicle traffic. Wrong-way riding is the primary cause of bicycle crashes and violates the "Rules of the Road" stated in the Uniform Vehicle Code. Bicycle lanes on one-way streets should be on the right side of the street, except in areas where a bicycle lane on the left will decrease the number of conflicts (e.g., those caused by heavy bus traffic). In unique situations, it may be appropriate to provide a contra-flow bicycle lane on the left side of a one-way street. Where this occurs, the lane should be marked with a solid, double yellow line and the width of the lane should be increased by one foot.

9.6.1 Lane Widths

Under ideal conditions, the minimum bicycle lane width is five feet. However, certain edge conditions dictate additional desirable bicycle lane width. Figure 1003.2A from the Caltrans Highway Design Manual, on the following page, depicts four common dimensions for such facilities and their relations to the roadway.

The first configuration depicts bicycle lanes on an urban curbed street where a striped parking lane is provided. The minimum bicycle lane width for this location is five feet. If parking volume is substantial or turnover is high, an additional one or two feet of width is desirable for safe bicycle operation. Bicycle lanes should always be placed between the parking lane and the motor vehicle lanes. Bicycle lanes between the curb and the parking lane can create obstacles for cyclists and eliminate a cyclist's ability to avoid a car door as it is opened. Therefore, this placement should not be considered.

The second configuration depicts an urban curbed street where parking is allowed, but without striping for a separate bike lane. This parking lane shared with bicycles should be 11 to 12 feet wide. 13 feet is recommended where parking turnover is high, such as commercial districts. Cyclists do not generally ride near a curb because of the possibility of debris, of hitting a pedal on the curb, of an uneven longitudinal joint, or of a steeper cross slope.

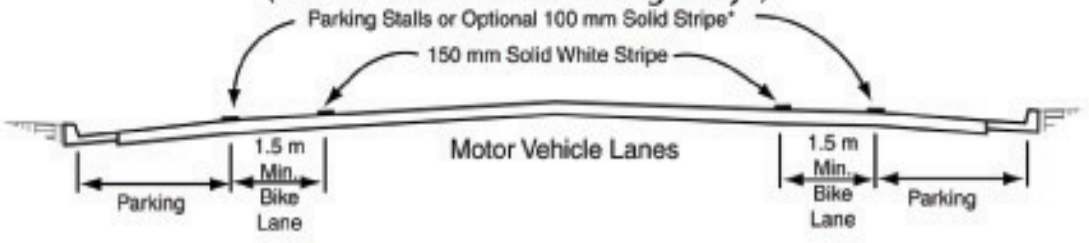
The third configuration of Figure 1003.2A shows a roadway where parking is prohibited. Bicycle lanes in this location should have a minimum width of five feet where a curb occurs (measured from the curb face) and four feet where no curb is used. If the longitudinal joint between the gutter pan and the roadway surface is uneven and falls within five feet of the curb face, a minimum of four feet should be provided between the joint and the motor vehicle lanes.

The fourth configuration of Figure 1003.2A depicts bicycle lanes on a roadway where parking is prohibited and without curbs. Bicycle lanes should be located between the motor vehicle lanes and the roadway shoulders. In this situation, bicycle lanes may have a minimum width of four feet, since the shoulder can provide additional maneuvering width. A width of five feet or greater is preferable. Additional widths are desirable where substantial truck traffic is present, or where vehicle speeds exceed 40 m.p.h. In certain situations, it may be appropriate to designate the full shoulder as the bike lane.

9.6.2 Intersections

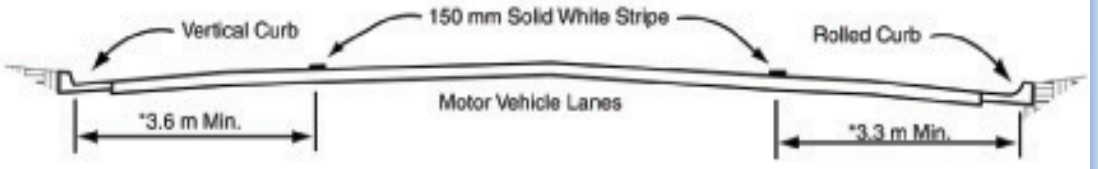
Bicycle lanes tend to complicate both bicycle and motor vehicle turning movements at intersections. Because they encourage cyclists to keep to the right and motorists to keep to the left, both operators are somewhat discouraged from merging in advance of turns. Because of this, some cyclists will begin left turns from the right side of the bicycle lane and some motorists will begin right turns from the left side of the bicycle lane. Both maneuvers are contrary to established "Rules of the Road" and result in conflicts.

Figure 1003.2A
Ty pical Bike Lane Cross Sections
(On 2-lane or Multilane Highways)



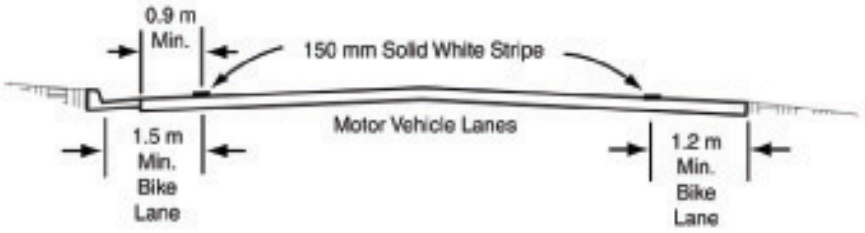
*The optional solid white stripe may be advisable where stalls are unnecessary (because parking is light) but there is concern that motorists may misconstrue the bike lane to be a traffic lane.

(1) STRIPED PARKING

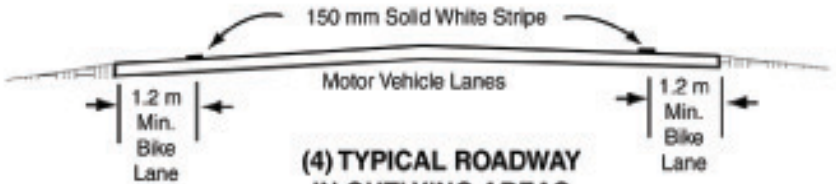


* 3.9 is recommended where there is substantial parking or turnover of parked cars is high (e.g. commerical areas).

(2) PARKING PERMITTED WITHOUT PARKING STRIPE OR STALL



(3) PARKING PROHIBITED



(4) TYPICAL ROADWAY IN OUTLYING AREAS PARKING RESTRICTED

Design treatment for bicycle lanes at a simple intersection is shown in Figure 1003.2B of the Caltrans *Highway Design Manual*. On a two-lane roadway, the edge line along the bike lane should end approximately 200 feet from the intersection to allow left turning cyclists and right turning motorists to "weave" as needed to safely complete their turns.

Design treatment at multi-lane intersections is more complex. Figure 1003.2C of the Caltrans *Highway Design Manual* presents examples of pavement markings for bicycle lanes approaching motorist right-turn-only lanes. Where there is numerous left turning cyclists, a separate turning lane should be considered.

The design of bicycle lanes should also include appropriate signing at intersections to reduce the number of conflicts. General guidance for pavement marking of bicycle lanes is contained in Section 1003.2 of the Caltrans *Highway Design Manual*. (See the Caltrans *Traffic Manual* for additional information.)

9.6.3 Signing and Striping Requirements

Signing and striping should be in accordance with Section 1004 of the Caltrans *Highway Design Manual* and the Caltrans *Traffic Manual*. Bicycle lanes should be well marked and signed to ensure clear understanding of the presence and purpose of the facility by both cyclists and motorists. The Caltrans *Traffic Manual* also specifies standard signing for bicycle lanes. The appropriate signs should be used in advance of the beginning of a marked designated bicycle lane to call attention to the lane and to the possible presence of cyclists. Signs should be used only in conjunction with the appropriate pavement marking and erected at periodic intervals along the designated bicycle lane and in the vicinity of locations where the preferential lane symbol is used.

Where it is necessary to restrict parking, standing, or stopping in a designated bicycle lane, appropriate signs, as described in the Caltrans *Traffic Manual*, may be used. For example, some cities employ a combination "NO PARKING/BIKE LANE" sign, especially where frequent stopping is a problem.

Bicycle lane stripes should be solid, six to eight inch wide white lines. Care should be taken to use skid-resistant pavement striping. Thermoplastic tape and painted markings can become slippery and cause the cyclist to fall. Impregnated grit, nonskid, preformed tape is an acceptable striping material.

It is very important to reapply bicycle lane markings when they begin to fade, since faded bicycle lane markings can lead to confusion for motorists and cyclists. If necessary, reapplication of bicycle lane stripes should be placed on a more frequent schedule than regular roadway re-striping projects. Old markings should be removed prior to re-striping if new layers of marking materials would otherwise create raised areas that would be hazardous to cyclists.

Prompt replacement of bicycle lane striping following pavement repairs should be the responsibility of the paving contractor for projects that have required the removal and replacement of bike lane paving. Too often, lane striping is not replaced following construction or repaving projects.

Preferential bicycle lane symbols should be installed on the pavement in bicycle lanes. Symbols should be installed at regular intervals (no more that 350 feet between symbols), immediately after intersections and at areas where bicycle lanes begin. Pavement letters that spell "BIKE ONLY," and arrows are optional, but desirable. (See Figure 1004.4 of the Caltrans *Highway Design Manual*.)

9.6.4 Miscellaneous Bikeway Criteria

In addition to adequate pavement surface and traffic signals responsive to bicycles, bicycle-safe grate inlets and safe railroad crossings should always be provided on roadways where bicycle lanes are being designated.

Bicycle-safe Grate Inlets

Drainage inlet grates should be maintained flush with the surface. Drainage inlet grates on bikeways openings must be narrow enough and short enough to prevent bicycle tires from dropping into the grates, regardless of the direction of bicycle travel. The Caltrans *Highway Design Manual* states; "Where it is not immediately feasible to replace existing grates with standard grates designed for bicycles...steel cross straps should be welded to the grates ...to reduce the size of the openings."

Grates with slots parallel to expected bicycle travel only should never be used. Most bicycle-safe grate inlets currently in use have vertical slats perpendicular to the roadway spaced roughly two inches apart. Some safe designs have more widely spaced slats angled to improve hydraulic flow. Other effective grate designs employ honeycomb or herringbone hole patterns, including a design approved by Caltrans.

Curb-face inlets take the water into a hole in the curb and have no slots on the road surface. While curb-face inlets offer an excellent solution, removing the grate entirely, they can cause handling problems for bikes if the roadway slopes excessively toward the inlet.

Safe Rail Crossings

Safe rail crossings eliminate the gaps along the rails with flangeway fillers and are aligned so that cyclists are directed to cross the tracks at a perpendicular angle to avoid slipping on the smooth metal that can occur when crossing at an oblique angle. (See Section 1003.6 of the Caltrans *Highway Design Manual*.)

Raised Pavement Markings and Barriers

Raised pavement markings and raised barriers can cause steering difficulties for cyclists and should not be used to delineate bicycle lanes.

9.7 Class 3 Facilities

A Class 3 facility is a suggested bicycle route that usually consists of a series of signs designating a preferred route between destinations such as residential and shopping areas. A network of such routes can provide access to a number of destinations throughout the community. In some cases, looped systems of scenic routes have been created to provide users with a series of recreational experiences. In addition, such routes can provide relatively safe connections for commuting to workplaces or schools.

The designation of a roadway as a Class 3 facility should be based primarily on the advisability of encouraging bicycle use on that particular roadway. While the roadways chosen for bicycle routes may not be free of problems, they should offer the best balance of safety and convenience of the available alternatives. In general, the most important considerations are pavement width and geometrics, traffic conditions and appropriateness of the intended purpose. A certain amount of risk and liability exists for any area that is signed as a Class 3 route. The message to the user public is that the facility is a safe route. Therefore, routes should not be placed on streets that do not meet appropriate safety standards.

Attributes that describe how appropriate a particular road is for a bicycle route include directness, connectivity with other bicycle facilities, scenery and available services. Directness is important for cyclists traveling for a purpose, such as commuting, though this is not the case for recreational riders, for whom scenery may be the primary factor in selecting a route. For recreational riders traveling more than a few miles, services such as food, water, restrooms and pressurized air may be of interest.

9.7.1 Roadway Engineering

While design of all Class 1 and 2 bikeways should follow the Bikeway Planning and Design Chapter 1000 of Caltrans' *Highway Design and Traffic Manuals*, there are bound to be situations where the recommended geometrics for a Class 3 facility can not be achieved, such as due to right-of-way constraints, for example. Planning and design of the Class 3 facility should emphasize safety for cyclists and provide additional warnings to motorists to be aware of the presence of cyclists.

Appendices

Appendix A: Agency Publications

Assembly Concurrent Resolution Number 211

On May 16, 2002 (the official California Bike-to-Work Day), Assembly Member Joe Nation (D-San Rafael) introduced Assembly Concurrent Resolution Number 211, relative to integrating walking and biking into transportation infrastructure. This advisory measure encourages all cities and counties to implement the policies of the California Department of Transportation Deputy Directive 64 and the United States Department of Transportation's design guidance document on integrating bicycling and walking when building their transportation infrastructure. The text of the resolution is as follows:

WHEREAS, Bicycling and walking contribute to cleaner air; and

WHEREAS, Bicycling and walking provide affordable and healthy transportation options for many of the 10 million Californians who do not possess a driver's license; and

WHEREAS, The State Department of Health Services has declared that more than 40,000 Californians annually die from causes related to physical inactivity; and

WHEREAS, The United States Centers for Disease Control has determined that changes in the community environment to promote physical activity may offer the most practical approach to prevent obesity or reduce its co-morbidities. Automobile trips that can be safely replaced by walking or bicycling offer the first target for increased physical activity in communities; and

WHEREAS, Bicycling and walking contribute to safeguarding our coast from offshore oil drilling and enhance California's energy independence and national security by reducing our reliance upon imported oil; and

WHEREAS, Designing roads for safe and efficient travel by bicyclists and pedestrians saves lives; and

WHEREAS, Bicyclists and pedestrians pay sales taxes which provide for the majority of local transportation spending; and

WHEREAS, Local demand for funding from the Bicycle Transportation Account, the Safe Routes to School, and the Transportation Enhancement Activity Programs far exceeds available moneys; and

WHEREAS, The best use of limited financial resources is to include bicycle and pedestrian elements into roadway projects where feasible; and

WHEREAS, Bicycling and walking reduce traffic congestion in California; and

WHEREAS, In February 2000, the United States Department of Transportation issued a design guidance statement titled, "Accommodating Bicycle and Pedestrian Travel: A Recommended Approach-A United States Department of Transportation Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure;" and

WHEREAS, In March 2001, the California Department of Transportation issued Deputy Directive 64 titled “Accommodating Non-Motorized Travel” which states that “The Department fully considers the needs of non-motorized travelers (including pedestrians, bicyclists and persons with disabilities) in all programming, planning maintenance, construction, operations, and project development activities and products. This includes incorporation of the best available standards in all of the Department’s practices. The Department adopts the best practices concepts in the US DOT Policy Statement on Integrating Bicycling And Walking into Transportation Infrastructure;” now, therefore, be it

RESOLVED by the Assembly of the State of California, the Senate thereof concurring, That in order to improve the ability of all Californians who choose to walk or bicycle to do so safely and efficiently, the Legislature of the State of California hereby encourages all cities and counties to implement the policies of the California Department of Transportation Deputy Directive 64 and the United States Department of Transportation’s design guidance document on integrating bicycling and walking when building their transportation infrastructure.

California Department of Transportation Deputy Directive Number: DD-64

Title: Accommodating Non-Motorized Travel

Policy

The Department fully considers the needs of non-motorized travelers (including pedestrian bicyclists and persons with disabilities) in all programming, planning, maintenance, construction, operations and project development activities and products. This includes incorporation of the best available standards in all of the Department's practices. The Department adopts the best practice concepts in the U.S. DOT Policy Statement on "Integrating Bicycling and Walking into Transportation Infrastructure."

Definition/Background

The planning and project development process seeks to provide the people of California with a degree of mobility that is in balance with other values. They must ensure that economic, social and environmental effects are fully considered along with technical issues, so that the best interest of the public is served. This includes all users of California's facilities and roadways.

Attention must be given to many issues including, but not limited to, the following:

- Safe and efficient transportation for all users of the transportation system
- Provision of alternatives for non-motorized travel
- Support of the Americans With Disabilities Act (ADA)
- Attainment of community goals and objectives
- Transportation needs of low-mobility, disadvantaged groups
- Support of the state's economic development
- Elimination or minimization of adverse effects on the environment, natural resources, public services, aesthetic features and the community
- Realistic financial estimates
- Cost effectiveness

Individual projects are selected for construction on the basis of overall multimodal system benefits as well as community goals, plans and values. Decisions place emphasis on making different transportation modes work together safely and effectively. Implicit in these objectives is the need to accommodate non-motorized travelers as an important consideration in improving the transportation system.

Responsibilities

Deputy Director, Planning and Modal Programs:

- Ensures that the needs of non-motorized travelers are incorporated into the program element of Transportation Planning and the modal elements of the statewide strategy for mobility.
- Ensures that liaison exists with non-motorized advocates to incorporate non-motorized needs into all program areas including project and system planning.
- Ensures that the needs of the non-motorized travelers are incorporated in personal movement strategies.

Deputy Director, Project Delivery:

- Ensures that projects incorporate best practices for non-motorized travel in the design and construction of capital projects.

Deputy Director, Maintenance and Operations:

- Ensures that the transportation system is maintained and operated in a safe and efficient manner with the recognition that non-motorized travel is a vital element of the transportation system.
- Ensures that the needs of non-motorized travelers are met in maintenance work zones.

District Directors:
- Ensure that best practices for non-motorized travel are included in all district projects and project planning.
- Ensure that best practices for non-motorized travel are implemented in maintenance and travel operations practices.

Chief, Division of Design
- Ensures that project delivery procedures and design guidance include the needs of non-motorized travelers as a regular part of doing business.
- Ensures that all project delivery staff is trained and consider the needs of the non-motorized traveler while developing and designing transportation projects.

Chief, Division of Planning:
- Ensures incorporation of non-motorized travel elements in transportation plans, programs and studies prepared by Transportation Planning.
- Ensures planning staff understand and are trained in the principles and design guidelines, non-motorized funding sources and the planning elements of non-motorized transportation.
- Coordinates Caltrans projects with non-motorized interest groups.
- Ensures incorporation of non-motorized travel elements in Corridor Studies prepared by Transportation Planning.

Chief, Division of Environmental Analysis:
- Ensures that non-motorized travel groups potentially affected by Caltrans projects are identified and have the opportunity to be involved in the project development process.
- Advocates effectively for all reasonable project-specific best practices that support or promote non-motorized travel.

Chief, Division of Maintenance:
- Ensures State-owned facilities are maintained consistent with the needs of motorized and non-motorized travelers.
- Provides guidance and training to those maintaining roadways to be aware of and sensitive to the needs of non-motorized travel.

Chief, Division of Traffic Operations:
- Ensures that the transportation system is operated in accordance with the needs of all travelers including non-motorized travel.
- Provides training and guidance on the operation of the transportation facility consistent with providing mobility for all users.
- Recommends safety measures in consideration of non-motorized travel on California's transportation system.

Chief, Division of Local Assistance:
- Ensures that Local Assistance staff, local agencies and interest groups are familiar with funding programs that are available for non-motorized travelers.
- Ensures that program coordinators responsible for non-motorized travel modes are familiar with non-motorized issues and advocate on behalf of non-motorized travelers.

Applicability

All Caltrans employees who are involved in the planning, design, construction, maintenance and operations of the transportation system.

TONY V. HARRIS
Chief Deputy Director

Design Guidance Accommodating Bicycle and Pedestrian Travel:

A Recommended Approach: A US DOT Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure

Purpose

Accommodating Bicycle and Pedestrian Travel: A Recommended Approach is a policy statement adopted by the United States Department of Transportation. USDOT hopes that public agencies, professional associations, advocacy groups, and others adopt this approach as a way of committing themselves to integrating bicycling and walking into the transportation mainstream.

The Design Guidance incorporates three key principles:
a) a policy statement that bicycling and walking facilities will be incorporated into all transportation projects unless exceptional circumstances exist;

b) an approach to achieving this policy that has already worked in State and local agencies; and

c) a series of action items that a public agency, professional association, or advocacy group can take to achieve the overriding goal of improving conditions for bicycling and walking.

The Policy Statement was drafted by the U.S. Department of Transportation in response to Section 1202 (b) of the Transportation Equity Act for the 21st Century (TEA-21) with the input and assistance of public agencies, professional associations and advocacy groups.

Introduction

Bicycling and walking issues have grown in significance throughout the 1990s. As the new millennium dawns public agencies and public interest groups alike are striving to define the most appropriate way in which to accommodate the two modes within the overall transportation system so that those who walk or ride bicycles can safely, conveniently, and comfortably access every destination within a community.

Public support and advocacy for improved conditions for bicycling and walking has created a widespread acceptance that more should be done to enhance the safety, comfort, and convenience of the non-motorized traveler. Public opinion surveys throughout the 1990s have demonstrated strong support for increased planning, funding and implementation of shared use paths, sidewalks and on-street facilities.

At the same time, public agencies have become considerably better equipped to respond to this demand. Research and practical experience in designing facilities for bicyclists and pedestrians has generated numerous national, state and local design manuals and resources. An increasing number of professional planners and engineers are familiar with this material and are applying this knowledge in towns and cities across the country.

The 1990 Americans with Disabilities Act, building on an earlier law requiring curb ramps in new, altered, and existing sidewalks, added impetus to improving conditions for sidewalk users. People with disabilities rely on the pedestrian and transit infrastructure, and the links between them, for access and mobility.

Congress and many State legislatures have made it considerably easier in recent years to fund non-motorized projects and programs (for example, the Intermodal Surface Transportation Efficiency Act and the Transportation Equity Act for the 21st Century), and a number of laws and regulations now mandate certain planning activities and design standards to guarantee the inclusion of bicyclists and pedestrians.

Despite these many advances, injury and fatality numbers for bicyclists and pedestrians

remain stubbornly high, levels of bicycling and walking remain frustratingly low, and most communities continue to grow in ways that make travel by means other than the private automobile quite challenging. Failure to provide an accessible pedestrian network for people with disabilities often requires the provision of costly paratransit service. Ongoing investment in the Nation's transportation infrastructure is still more likely to overlook rather than integrate bicyclists and pedestrians.

In response to demands from user groups that every transportation project include a bicycle and pedestrian element, Congress asked the Federal Highway Administration (FHWA) to study various approaches to accommodating the two modes. The Transportation Equity Act for the 21st Century (TEA-21) instructs the Secretary to work with professional groups such as AASHTO, ITE, and other interested parties to recommend policies and standards that might achieve the overall goal of fully integrating bicyclists and pedestrians into the transportation system.

TEA-21 also says that, "Bicycle transportation facilities and pedestrian walkways shall be considered, where appropriate, in conjunction with all new construction and reconstruction of transportation projects, except where bicycle and pedestrian use are not permitted." (Section 1202)

Sec. 1202. Bicycle Transportation And Pedestrian Walkways.
(b) Design Guidance.

(1) In general - In implementing section 217(g) of title 23, United States Code, the Secretary, in cooperation with the American Association of State Highway and Transportation Officials, the Institute of Transportation Engineers, and other interested organizations, shall develop guidance on the various approaches to accommodating bicycles and pedestrian travel.

(2) Issues to be addressed - The guidance shall address issues such as the level and nature of the demand, volume, and speed of motor vehicle traffic, safety, terrain, cost, and sight distance.

(3) Recommendations - The guidance shall include recommendations on amending and updating the policies of the American Association of State Highway and Transportation Officials relating to highway and street design standards to accommodate bicyclists and pedestrians.

(4) Time period for development - The guidance shall be developed within 18 months after the date of enactment of this Act.

In August 1998, FHWA convened a Task Force comprising representatives from FHWA, AASHTO, ITE, bicycle and pedestrian user groups, State and local agencies, the U.S. Access Board and representatives of disability organizations to seek advice on how to proceed with developing this guidance. The Task Force reviewed existing and proposed information on the planning and technical design of facilities for bicyclists and pedestrians and concluded that these made creation of another design manual unnecessary. For example, AASHTO published a bicycle design manual in 1999 and is working on a pedestrian facility manual.

The area where information and guidance was most lacking was in determining when to include designated or special facilities for bicyclists and pedestrians in transportation projects. There can also be uncertainty about the type of facility to provide, and the design elements that are required to ensure accessibility.

For example, when a new suburban arterial road is planned and designed, what facilities for bicyclists and pedestrians should be provided? The task force felt that once the decision to provide a particular facility was made, the specific information on designing that facility is generally available. However, the decision on whether to provide sidewalks on neither,

one or both sides of the road, or a shoulder, striped bike lane, wide outside lane or separate trail for bicyclists is usually made with little guidance or help.

After a second meeting with the Task Force in January 1999, FHWA agreed to develop a Policy Statement on Accommodating Bicyclists and Pedestrians in Transportation Projects to guide State and local agencies in answering these questions. Task Force members recommended against trying to create specific warrants for different facilities (warrants leave little room for engineering judgment and have often been used to avoid providing facilities for bicycling and walking). Instead, the purpose of the Policy Statement is to provide a recommended approach to the accommodation of bicyclists and pedestrians that can be adopted by State and local agencies (as well as professional societies and associations, advocacy groups, and Federal agencies) as a commitment to developing a transportation infrastructure that is safe, convenient, accessible, and attractive to motorized AND non-motorized users alike. The Policy Statement has four elements:

a) An acknowledgment of the issues associated with balancing the competing interests of motorized and non-motorized users;

b) A recommended policy approach to accommodating bicyclists and pedestrians (including people with disabilities) that can be adopted by an agency or organizations as a statement of policy to be implemented or a target to be reached in the future;

c) A list of recommended actions that can be taken to implement the solutions and approaches described above; and

d) Further information and resources on the planning, design, operation, and maintenance of facilities for bicyclists and pedestrians.

The Challenge: Balancing Competing Interests

For most of the second half of the 20th Century, the transportation, traffic engineering and highway professions in the United States were synonymous. They shared a singular purpose: building a transportation system that promoted the safety, convenience and comfort of motor vehicles. The post-war boom in car and home ownership, the growth of suburban America, the challenge of completing the Interstate System, and the continued availability of cheap gasoline all fueled the development of a transportation infrastructure focused almost exclusively on the private motor car and commercial truck.

Initially, there were few constraints on the traffic engineer and highway designer. Starting at the centerline, highways were developed according to the number of motor vehicle travel lanes that were needed well into the future, as well as providing space for breakdowns. Beyond that, facilities for bicyclists and pedestrians, environmental mitigation, accessibility, community preservation, and aesthetics were at best an afterthought, often simply overlooked, and, at worst, rejected as unnecessary, costly, and regressive. Many States passed laws preventing the use of State gas tax funds on anything other than motor vehicle lanes and facilities. The resulting highway environment discourages bicycling and walking and has made the two modes more dangerous. Further, the ability of pedestrians with disabilities to travel independently and safely has been compromised, especially for those with vision impairments.

Over time, the task of designing and building highways has become more complex and challenging. Traffic engineers now have to integrate accessibility, utilities, landscaping, community preservation, wetland mitigation, historic preservation, and a host of other concerns into their plans and designs - and yet they often have less space and resources within which to operate and traffic volumes continue to grow.

The additional “burden” of having to find space for pedestrians and bicyclists was rejected as impossible in many communities because of space and funding constraints and a per-

ceived lack of demand. There was also anxiety about encouraging an activity that many felt to be dangerous and fraught with liability issues. Designers continued to design from the centerline out and often simply ran out of space before bike lanes, paved shoulders, sidewalks and other "amenities" could be included.

By contrast, bicycle and pedestrian user groups argue the roadway designer should design highways from the right-of-way limits in, rather than the centerline out. They advocate beginning the design of a highway with the sidewalk and/or trail, including a buffer before the paved shoulder or bike lane, and then allocating the remaining space for motor vehicles. Through this approach, walking and bicycling are positively encouraged, made safer, and included as a critical element in every transportation project rather than as an afterthought in a handful of unconnected and arbitrary locations within a community.

Retrofitting the built environment often provides even more challenges than building new roads and communities: space is at a premium and there is a perception that providing better conditions for bicyclists and pedestrians will necessarily take away space or convenience from motor vehicles.

During the 1990s, Congress spearheaded a movement towards a transportation system that favors people and goods over motor vehicles with passage of the Intermodal Surface Transportation Efficiency Act (1991) and the Transportation Equity Act for the 21st Century (1998). The call for more walkable, livable, and accessible communities, has seen bicycling and walking emerge as an "indicator species" for the health and well-being of a community. People want to live and work in places where they can safely and conveniently walk and/or bicycle and not always have to deal with worsening traffic congestion, road rage and the fight for a parking space. Vice President Gore launched a Livability Initiative in 1999 with the ironic statement that "a gallon of gas can be used up just driving to get a gallon of milk."

The challenge for transportation planners, highway engineers and bicycle and pedestrian user groups, therefore, is to balance their competing interest in a limited amount of right-of-way, and to develop a transportation infrastructure that provides access for all, a real choice of modes, and safety in equal measure for each mode of travel.

This task is made more challenging by the widely divergent character of our nation's highways and byways. Traffic speeds and volumes, topography, land use, the mix of road users, and many other factors mean that a four-lane highway in rural North Carolina cannot be designed in the same way as a four-lane highway in New York City, a dirt road in Utah or an Interstate highway in Southern California. In addition, many different agencies are responsible for the development, management, and operation of the transportation system.

In a recent memorandum transmitting Program Guidance on bicycle and pedestrian issues to FHWA Division Offices, the Federal Highway Administrator wrote, "We expect every transportation agency to make accommodation for bicycling and walking a routine part of their planning, design, construction, operations and maintenance activities." The Program Guidance itself makes a number of clear statements of intent:

- Congress clearly intends for bicyclists and pedestrians to have safe, convenient access to the transportation system and sees every transportation improvement as an opportunity to enhance the safety and convenience of the two modes.

- "Due consideration" of bicycle and pedestrian needs should include, at a minimum, a presumption that bicyclists and pedestrians will be accommodated in the design of new and improved transportation facilities.

- To varying extents, bicyclists and pedestrians will be present on all highways and transportation facilities where they are permitted and it is clearly the intent of TEA-21 that all new and improved transportation facilities be planned, designed and con-

structed with this fact in mind.

- The decision not to accommodate [bicyclists and pedestrians] should be the exception rather than the rule. There must be exceptional circumstances for denying bicycle and pedestrian access either by prohibition or by designing highways that are incompatible with safe, convenient walking and bicycling.

The Program Guidance defers a suggested definition of what constitutes "exceptional circumstances" until this Policy Statement is completed. However, it does offer interim guidance that includes controlled access highways and projects where the cost of accommodating bicyclists and pedestrians is high in relation to the overall project costs and likely level of use by non-motorized travelers.

Providing access for people with disabilities is a civil rights mandate that is not subject to limitation by project costs, levels of use, or "exceptional circumstances". While the Americans with Disabilities Act does not require pedestrian facilities in the absence of a pedestrian route, it does require that pedestrian facilities, when newly constructed or altered, be accessible.

Policy Statement

1. Bicycle and pedestrian ways shall be established in new construction and reconstruction projects in all urbanized areas unless one or more of three conditions are met:

- Bicyclists and pedestrians are prohibited by law from using the roadway. In this instance, a greater effort may be necessary to accommodate bicyclists and pedestrians elsewhere within the right of way or within the same transportation corridor.

- The cost of establishing bikeways or walkways would be excessively disproportionate to the need or probable use. Excessively disproportionate is defined as exceeding twenty percent of the cost of the larger transportation project.

- Where scarcity of population or other factors indicate an absence of need. For example, the Portland Pedestrian Guide requires "all construction of new public streets" to include sidewalk improvements on both sides, unless the street is a cul-de-sac with four or fewer dwellings or the street has severe topographic or natural resource constraints.

2. In rural areas, paved shoulders should be included in all new construction and reconstruction projects on roadways used by more than 1,000 vehicles per day, as is currently the case in Wisconsin. Paved shoulders have safety and operational advantages for all road users in addition to providing a place for bicyclists and pedestrians to operate.

Rumble strips are not recommended where shoulders are used by bicyclists unless there is a minimum clear path of four feet in which a bicycle may safely operate.

3. Sidewalks, shared use paths, street crossings (including over- and undercrossings), pedestrian signals, signs, street furniture, transit stops and facilities, and all connecting pathways shall be designed, constructed, operated and maintained so that all pedestrians, including people with disabilities, can travel safely and independently.

4. The design and development of the transportation infrastructure shall improve conditions for bicycling and walking through the following additional steps:

- Planning projects for the long-term. Transportation facilities are long-term investments that remain in place for many years. The design and construction of new facilities that meet the criteria in item 1) above should anticipate likely future demand for bicycling and walking facilities and not preclude the provision of future improvements. For

example, a bridge that is likely to remain in place for 50 years might be built with sufficient width for safe bicycle and pedestrian use in anticipation that facilities will be available at either end of the bridge even if that is not currently the case.

- Addressing the need for bicyclists and pedestrians to cross corridors as well as travel along them. Even where bicyclists and pedestrians may not commonly use a particular travel corridor that is being improved or constructed, they will likely need to be able to cross that corridor safely and conveniently. Therefore, the design of intersections and interchanges shall accommodate bicyclists and pedestrians in a manner that is safe, accessible and convenient.

- Getting exceptions approved at a senior level. Exceptions for the non-inclusion of bikeways and walkways shall be approved by a senior manager and be documented with supporting data that indicates the basis for the decision.

- Designing facilities to the best currently available standards and guidelines. The design of facilities for bicyclists and pedestrians should follow design guidelines and standards that are commonly used, such as the AASHTO Guide for the Development of Bicycle Facilities, AASHTO's A Policy on Geometric Design of Highways and Streets, and the ITE Recommended Practice "Design and Safety of Pedestrian Facilities".

Policy Approach

"Rewrite the Manuals" Approach

Manuals that are commonly used by highway designers covering roadway geometrics, roadside safety, and bridges should incorporate design information that integrates safe and convenient facilities for bicyclists and pedestrians — including people with disabilities - into all new highway construction and reconstruction projects.

In addition to incorporating detailed design information - such as the installation of safe and accessible crossing facilities for pedestrians, or intersections that are safe and convenient for bicyclists - these manuals should also be amended to provide flexibility to the highway designer to develop facilities that are in keeping with transportation needs, accessibility, community values, and aesthetics. For example, the Portland Pedestrian Design Guide (June 1998) applies to every project that is designed and built in the city, but the Guide also notes that:

"Site conditions and circumstances often make applying a specific solution difficult. The Pedestrian Design Guide should reduce the need for ad hoc decision by providing a published set of guidelines that are applicable to most situations. Throughout the guidelines, however, care has been taken to provide flexibility to the designer so she or he can tailor the standards to unique circumstances. Even when the specific guideline cannot be met, the designer should attempt to find the solution that best meets the pedestrian design principles described [on the previous page]"

In the interim, these manuals may be supplemented by stand-alone bicycle and pedestrian facility manuals that provide detailed design information addressing on-street bicycle facilities, fully accessible sidewalks, crosswalks, and shared use paths, and other improvements.

Examples: Florida DOT has integrated bicycle and pedestrian facility design information into its standard highway design manuals and New Jersey DOT is in the process of doing so. Many States and localities have developed their own bicycle and pedestrian facility design manuals, some of which are listed in the final section of this document.

Applying Engineering Judgment to Roadway Design

In rewriting manuals and developing standards for the accommodation of bicyclists and pedestrians, there is a temptation to adopt "typical sections" that are applied to roadways

without regard to travel speeds, lane widths, vehicle mix, adjacent land uses, traffic volumes and other critical factors. This approach can lead to inadequate provision on major roads (e.g. a four foot bike lane or four foot sidewalk on a six lane high-speed urban arterial) and the over-design of local and neighborhood streets (e.g. striping bike lanes on low volume residential roads), and leaves little room for engineering judgment.

After adopting the policy that bicyclists and pedestrians (including people with disabilities) will be fully integrated into the transportation system, State and local governments should encourage engineering judgment in the application of the range of available treatments.

For example:

- Collector and arterial streets shall typically have a minimum of a four foot wide striped bicycle lane, however wider lanes are often necessary in locations with parking, curb and gutter, heavier and/or faster traffic.

- Collector and arterial streets shall typically have a minimum of a five foot sidewalk on both sides of the street, however wider sidewalks and landscaped buffers are necessary in locations with higher pedestrian or traffic volumes, and/or higher vehicle speeds. At intersections, sidewalks may need to be wider to accommodate accessible curb ramps.

- Rural arterials shall typically have a minimum of a four foot paved shoulder; however wider shoulders (or marked bike lanes) and accessible sidewalks and crosswalks are necessary within rural communities and where traffic volumes and speeds increase.

This approach also allows the highway engineer to achieve the performance goal of providing safe, convenient, and comfortable travel for bicyclists and pedestrians by other means. For example, if it would be inappropriate to add width to an existing roadway to stripe a bike lane or widen a sidewalk, traffic calming measures can be employed to reduce motor vehicle speeds to levels more compatible with bicycling and walking.

Actions

The United States Department of Transportation encourages States, local governments, professional associations, other government agencies and community organizations to adopt this Policy Statement as an indication of their commitment to accommodating bicyclists and pedestrians as an integral element of the transportation system. By so doing, the organization or agency should explicitly adopt one, all, or a combination of the various approaches described above AND should be committed to taking some or all of the actions listed below as appropriate for their situation.

a) Define the exceptional circumstances in which facilities for bicyclists and pedestrians will NOT be required in all transportation projects.

b) Adopt new manuals, or amend existing manuals, covering the geometric design of streets, the development of roadside safety facilities, and design of bridges and their approaches so that they comprehensively address the development of bicycle and pedestrian facilities as an integral element of the design of all new and reconstructed roadways.

c) Adopt stand-alone bicycle and pedestrian facility design manuals as an interim step towards the adoption of new typical sections or manuals covering the design of streets and highways.

d) Initiate an intensive re-tooling and re-education of transportation planners and engineers to make them conversant with the new information required to accommodate bicyclists and pedestrians. Training should be made available for, if not required of, agency traffic engineers and consultants who perform work in this field.

Conclusion

There is no question that conditions for bicycling and walking need to be improved in every community in the United States; it is no longer acceptable that 6,000 bicyclists and pedestrians are killed in traffic every year, that people with disabilities cannot travel without encountering barriers, and that two desirable and efficient modes of travel have been made difficult and uncomfortable.

Every transportation agency has the responsibility and the opportunity to make a difference to the bicycle-friendliness and walkability of our communities. The design information to accommodate bicyclists and pedestrians is available, as is the funding. The United States Department of Transportation is committed to doing all it can to improve conditions for bicycling and walking and to make them safer ways to travel.

Additional Information and Resources

General Design Resources

A Policy on Geometric Design of Highways and Streets, 1994 (The Green Book). American Association of State Highway and Transportation Officials (AASHTO), P.O. Box 96716, Washington, DC, 20090-6716, Phone: (888) 227-4860.

Highway Capacity Manual, Special Report 209, 1994. Transportation Research Board, Box 289, Washington, DC 20055, Phone: (202) 334-3214. Next Edition: FHWA Research Program project has identified changes to HCM related to bicycle and pedestrian design.

Manual on Uniform Traffic Control Devices, 1988. Federal Highway Administration (FHWA), Superintendent of Documents. P.O. Box 371954, Pittsburgh, PA 15250-7954. Next Edition: 2000, will incorporate changes to Part IX that will soon be subject of Notice of Proposed Rulemaking.

Flexibility in Highway Design, 1997. FHWA. HEP 30, 400 Seventh Street SW, Washington, DC 20590.

Pedestrian Facility Design Resources

Design and Safety of Pedestrian Facilities, A Recommended Practice, 1998. Institute of Transportation Engineers, 525 School Street, S.W, Suite 410, Washington, DC 20024-2729, Phone: (202) 554-8050.

Pedestrian Compatible Roadways-Planning and Design Guidelines, 1995. Bicycle / Pedestrian Transportation Master Plan, Bicycle and Pedestrian Advocate, New Jersey Department of Transportation, 1035 Parkway Avenue, Trenton, NJ 08625, Phone: (609) 530-4578.

Improving Pedestrian Access to Transit: An Advocacy Handbook, 1998. Federal Transit Administration / WalkBoston. NTIS, 5285 Port Royal Road, Springfield, VA 22161.

Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas, Report No. 294A, Transportation Research Board, Box 289, Washington, DC 20055, Phone: (202) 334-3214.

Pedestrian Facilities Guidebook, 1997. Washington State Department of Transportation, Bicycle and Pedestrian Program, P.O. Box 47393, Olympia, WA 98504.

Portland Pedestrian Design Guide, 1998. Portland Pedestrian Program, 1120 SW Fifth Ave, Room 802; Portland, OR 97210. (503) 823-7004.

Implementing Pedestrian Improvements at the Local Level, 1999. FHWA, HSR 20, 6300 Georgetown Pike, McLean, VA . (Publication not yet available)

AASHTO Guide to the Development of Pedestrian Facilities, 2000. AASHTO. (Publication not yet available- currently under discussion)

Bikeway Facility Design Resources
Guide for the Development of Bicycle Facilities, 1999., American Association of State Highway and Transportation Officials (AASHTO), P.O. Box 96716, Washington, DC, 20090-6716, Phone: (888) 227-4860.

Implementing Bicycle Improvements at the Local Level, (1998), FHWA, HSR 20, 6300 Georgetown Pike, McLean, VA.

Bicycle Facility Design Standards, 1998. City of Philadelphia Streets Department, 1401 JFK Boulevard, Philadelphia, PA 19103.

Selecting Roadway Design Treatments to Accommodate Bicyclists, 1993. FHWA, R&T Report Center, 9701 Philadelphia Ct., Unit Q; Lanham, MD 20706. (301) 577-1421 (fax only)

North Carolina Bicycle Facilities Planning and Design Guidelines, 1994. North Carolina DOT, P.O. Box 25201, Raleigh, NC 27611. (919) 733-2804.

Bicycle Facility Planning, 1995. Pinsof & Musser. American Planning Association, Planning Advisory Service Report # 459. American Planning Association, 122 S. Michigan Ave, Suite 1600; Chicago, IL 60603.

Florida Bicycle Facilities Planning and Design Manual, 1994. Florida DOT, Pedestrian and Bicycle Safety Office, 605 Suwannee Street, Tallahassee, FL 32399.

Evaluation of Shared-use Facilities for Bicycles and Motor Vehicles, 1996. Florida DOT, Pedestrian and Bicycle Safety Office, 605 Suwannee Street, Tallahassee, FL 32399.

Bicycle and Pedestrian Design Resources
Oregon Bicycle and Pedestrian Plan, 1995. Oregon Department of Transportation, Bicycle and Pedestrian Program, Room 210, Transportation Building, Salem, OR 97310, Phone: (503) 986-3555

Improving Conditions for Bicyclists and Pedestrians, A Best Practices Report, 1998. FHWA, HEP 10, 400 Seventh Street SW, Washington, DC 20590.

Traffic Calming Design Resources
Traffic Calming: State of the Practice. 1999. Institute of Transportation Engineers, 525 School Street, SW, Suite 410; Washington, DC 20024.

Florida Department of Transportation's Roundabout Guide. Florida Department of Transportation, 605 Suwannee St., MS-82, Tallahassee, FL 23299-0450.

National Bicycling and Walking Study. Case Study # 19, Traffic Calming and Auto-Restricted Zones and other Traffic Management Techniques-Their Effects on Bicycling and Pedestrians, Federal Highway Administration (FHWA).

Traffic Calming (1995), American Planning Association, 122 South Michigan Avenue, Chicago, IL 60603

Traditional Neighborhood Development Street Design Guidelines, 1997. Proposed Recommended Practice, Institute of Transportation Engineers, 525 School Street, SW, Suite 410; Washington, DC 20024.

Making Streets that Work, City of Seattle, 600 Fourth Ave., 12th Floor, Seattle, WA 98104-

1873, Phone: (206) 684-4000, Fax: (206) 684-5360.

Traffic Control Manual for In-Street Work, 1994. Seattle Engineering Department, City of Seattle, 600 4th Avenue, Seattle, WA 98104-6967, Phone: (206) 684-5108.

ADA-Related Design Resources
Accessible Pedestrian Signals, 1998. U.S. Access Board 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253.

Accessible Rights of Way: A Design Manual, 1999. U.S. Access Board, 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253.

Designing Sidewalks and Trails for Access, Part One. 1999. FHWA, HEPH-30, 400 Seventh Street SW, Washington, DC 20590.

ADA Accessibility Guidelines for Buildings and Facilities, 1998 (ADAAG). U.S. Access Board, 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253.

Uniform Federal Accessibility Standards, 1984 (UFAS), available from the U.S. Access Board, 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253

Universal Access to Outdoor Recreation: A Design Guide, 1993. PLAE, Inc., MIG Communications, 1802 Fifth Street, Berkeley, CA 94710. (510) 845-0953.

Recommended Street Design Guidelines for People Who Are Blind or Visually Impaired. American Council of the Blind, 1155 15th Street NW, Suite 720; Washington, DC 20005. (202) 467-5081.

Trail Design Resources
Trails for the 21st Century, 1993. Rails to Trails Conservancy, 1100 17th Street NW, 10th Floor, Washington DC 20036. (202) 331-9696.

Greenways: A Guide to Planning, Design, and Development, 1993. The Conservation Fund. Island Press, 1718 Connecticut Ave NW, Suite 300; Washington, DC 20009.

Trail Intersection Design Guidelines, 1996. Florida Department of Transportation, 605 Suwannee St., MS-82, Tallahassee, FL 23299-0450.

Appendix B: Guidelines for Selecting Safe Routes To School

Choosing a safe bicycle route to school is different from choosing a safe walking route because bicyclists and pedestrians have different needs for maximum safety. The higher speed of bicyclists increases the need for visibility, smooth surfaces, and predictable interaction with other road users.

Note also that bicycle skills vary among students more than walking skills do, and they are usually acquired at a later age. Younger children have less skill at estimating closing speed for automobiles and have less ability to process peripheral vision. Younger children should therefore cycle mainly on less complicated streets, where they can focus on one hazard at a time. Older students will cycle faster, and so they need to have longer sight lines. Routes suitable for high schoolers may be unsuitable for elementary school students, and vice versa.

Publishing recommended routes to school is not sufficient for encouraging bicycling to school. Other measures are also needed, including bicycle education, safe bike parking, rewards for cycling (such as bike-to-school days), bike-to-school groups lead by an adult, and so forth.

When choosing safe bicycle routes to school, look for:

- The safest, most direct route. Detours to avoid hazards should not add significantly to the length of the ride, or they will be ignored.

- On-street routes. Children riding on the sidewalk have an increased risk of collision with an automobile 2.5 times over riding on the street. A “bike path” that parallels a road is the same as a sidewalk. Riding a bicycle on sidewalks is prohibited in most jurisdictions in California, at least in business districts.

Use off-street routes only when they have no intersections with streets or driveways, or when they provide a substantial short cut. The faster the cyclists, the more important it is to avoid sidewalks.

Bicyclists should ride on the right side of the street with traffic for maximum safety (wrong way sidewalk riding has the highest risk). When the road is so narrow and so busy that young cyclists cannot ride on it safely, they should walk their bikes on the sidewalk. Generally, this is only feasible to require near intersections with crossing guards.

Where uphill slopes are so steep that the cyclists cannot maintain a straight line (about percent slope equal to age up to 12 years old), students should get off and walk on their bikes on the sidewalk. Similarly steep downgrades require well-maintained brakes and training in braking on hills. Students without that training should walk their bikes down the hills.

- Adequate width of curb lane and good maintenance of road edge. For safe sharing of the curb lane by motorists and cyclists, it should be at least 14 feet wide, with no on-street parking—wider is better, particularly for younger cyclists who cannot hold as straight a line. Broken pavement and accumulated debris on the side of the road can narrow the effective width substantially. If there is a bike lane, its width can be

added to the rightmost travel lane to determine if width is adequate. On very quiet residential roads with low traffic speeds and good sight lines, even young children can safely take a lane, and wide curb lanes are not needed.

Also watch out for drain grates, potholes, obstructed visibility, dogs off-leash, and other obvious hazards. It is best to scout out the routes by bicycle and consult with bicyclists who regularly cycle in the area.

- Right turns, not left turns. It is much easier for a cyclist (particularly a beginning cyclist) to turn right than to turn left. This means that the best route away from school may differ from the best route to school.

There are two ways to do left-turns safely: merging into the left-turn lane or crossing, stopping, turning the bike in place, and crossing again. The merge-left technique can be learned by students as young as 9-10 years old (later for multi-lane streets), but younger students should cross to the far right corner and then cross over to the left.

When left-turns are necessary, it is best if they can be done from low-traffic streets onto low-traffic streets, with all-way stops or traffic signals. T-intersections make left turns even easier, since there are fewer motor vehicle movements to watch out for.

- No right-turn only lanes where cyclists go straight. Right-turn-only lanes require cyclists to merge across a lane of traffic to continue straight. This skill can be learned by middle-school students, but only with proper bicycle instruction.

Where right-turn-only lanes are unavoidable, younger cyclists should probably be directed to walk their bikes on the sidewalk.

- Few stop signs. Stopping requires significant extra effort to regain loss momentum, tempting students to run stop signs illegally. It is safer for them to ride on a slightly busier street with fewer stops and the protection of having the right of way, than to risk running stop signs.

- Only traffic signals that sense bicyclists and give sufficient green time. For a bicyclists to use intersections with traffic signals safely, the traffic signals should detect the bike and make sure there is enough green time for the cyclist to clear the intersection. Traffic signals that do no meet this standard should have their sensors adjusted and be re-timed. Younger children may need to dismount and become pedestrians, using the pedestrian push-button and walking their bikes in the crosswalk.

- Few curb cuts. The turning traffic at commercial driveways is a serious hazard to bicyclists (even more so if they are on the sidewalk).

- Low traffic volume and low speeds. Although this criterion is often the first one people think of, it is actually the least important because most accidents involve turning traffic, not passing traffic. A street with few intersections or curb cuts is safer, even if motor vehicle volume and speed is higher.

Appendix C: California Bicycle Laws and Safety

The following are important excerpts from the California Vehicle Code (VC) relating to the operation and equipping of bicycles.

VC 231 - Bicycle Defined

Defines bicycle as a device upon which any person may ride, propelled exclusively by human power through a belt, chain, or gears and having one or more wheels. Specifically provides that persons riding bicycles are subject to Vehicle Code provisions specified in Sections 21200 and 21200.5 (see below).

VC 21200 - Bicycle Use

Every person riding a bicycle upon a street or highway has all the rights and is subject to all the duties applicable to the driver of a vehicle, including the provisions of law dealing with driving under the influence of alcoholic beverages or drugs, except those provisions that by their very nature can have no application.

Bicycling Under Influence of Alcohol or Drugs. VC 21200.5
Provides that it is unlawful to ride a bicycle upon a street or highway while under the influence of an alcoholic beverage or drug or the combination of alcohol and a drug, punishable by a fine of up to $250. A person arrested may request a chemical test. If the person is under 21 but over 13 years of age, his or her driving privilege will be suspended for one year or delayed for one year once the person is eligible to drive.

VC 21201 - Equipment Requirements

a) No person shall operate a bicycle on a roadway unless it is equipped with a brake that will enable the operator to make one braked wheel skid on dry, level, clean pavement.

b) No person shall operate on the highway any bicycle equipped with handlebars so raised that the operator must elevate their hands above the level of their shoulders in order to grasp the normal steering grip area.

c) No person shall operate upon any highway a bicycle that is of such a size as to prevent the operator from safely stopping the bicycle, supporting it in an upright position with at least one foot on the ground, and restarting it in a safe manner.

d) Every bicycle operated upon any highway during darkness shall be equipped with the following:

1. A lamp emitting a white light that illuminates the highway and is visible from a distance of 300 feet to the front and the sides of the bicycle.

2. A red reflector mounted on the rear of the bicycle and visible from 500 feet to the rear of the bicycle.

3. A white or yellow reflector mounted on each pedal visible 200 feet to the front and rear of the bicycle and a white or red reflector on each side to the rear of the center of the bicycle, except bicycles which are equipped with reflectorized tires on the front and the rear need not be equipped with side reflectors. All reflectorized tires must meet DMV requirements.

e) A lamp or lamp combination, emitting a white light, attached to the operator and visible from a distance of 300 feet in front and from the sides of the bicycle, may be used in place of a lamp attached to the bike.

VC 21202 - Duty of Bicycle Operator: Operation On Roadway

a) Any person operating a bicycle upon a roadway at a speed less than the normal speed of traffic moving in the same direction at such time shall ride as close as practicable to the right-hand curb or edge of the roadway except under any of the following situations:

1. When overtaking and passing another bicycle or motor vehicle proceeding in the same direction.

2. When preparing for a left turn at an intersection or into a private road or driveway.

3. When reasonably necessary to avoid conditions (including, but not limited to, fixed or moving objects, vehicles, bicycles, pedestrians, animals, surface hazards, or substandard width lanes) that make it unsafe to continue along the right-hand curb or edge. For purposes of this section, a “substandard width lane” is a lane that is too narrow for a bicycle and a vehicle to travel safely side by side within the lane.

b) Any person operating a bicycle on a one-way street or highway with two or more marked traffic lanes, may ride as near the left-hand curb or edge of such roadway as practicable.

VC 21203 - Hitching Rides

No person riding upon any motorcycle, motorized bicycle, bicycle, coaster, roller skates, sled, or toy vehicle shall attach the same or themselves to any streetcar or vehicle on the roadway.

VC 21204 - Riding On Bicycle

a) No person operating a bicycle on a highway shall ride other than on a permanent and regular attached seat.

b) No person operating a bicycle on a highway shall allow anyone to ride as a passenger other than on a separate attached seat. If the passenger is four years old or younger or weighs 40 pounds or less, the seat shall adequately retain the passenger in place and protect him/her from the bicycle’s moving parts.

VC 21205 - Carrying Articles

No person operating a bicycle shall carry any package, bundle, or article which prevents the operator from keeping at least one hand upon the handlebars.

VC 21208 - Permitted Movements from Bicycle Lanes

a) Whenever a bicycle lane has been established on a roadway, any person operating a bicycle upon the roadway at a speed less than the normal speed of traffic moving in the same direction shall ride in the bicycle lane, except under the following situations.

1. When overtaking or passing another bicycle, vehicle, or pedestrian within the lane or about to enter the lane if such overtaking and passing cannot be done safely within the lane.

2. When preparing for a left turn at an intersection or into a private road or driveway.

3. When necessary to leave the lane to avoid debris or other hazardous conditions.

b) No operator of a bicycle shall leave a bicycle lane until it can be done safely and then only after giving an appropriate hand signal in the event that any vehicle might be affected by the movement.

VC 21210 - Parking
No person shall leave a bicycle lying on its side on any sidewalk, or shall park a bicycle on a sidewalk in any other position, so that there is not an adequate path for pedestrian traffic. Local authorities may prohibit bicycle parking in designated areas of the public highway, provided appropriate signs are erected.

VC 21211 - Obstruction of Bikeways
No person shall place or park a bicycle or vehicle so as to impede or block the normal and reasonable movement of any bicyclist on a bikeway or bicycle path or trail unless the placement or parking is necessary for safe operation or otherwise in compliance with the law.

VC 21212 - Youth Helmets
Prohibits persons under 18 from riding or being a passenger on a bicycle without wearing helmets meeting specified standards (ANSI or SNELL). Violations are punishable by a fine of not more than $25.

VC 21650.1 - Bicycles on Roadways
A bicycle operated on a roadway or highway shoulder shall be operated in the same direction as vehicles are required to drive upon the roadway.

VC 21960 - Bicycling on Freeways
a) The Department of Transportation and local authorities may prohibit or restrict the use of freeways or any portion thereof by bicycles.

b) Such prohibitory regulations shall be effective when appropriate signs giving notice thereof are erected upon the freeway and the approaches thereto.

VC 22111 - Hand Signals
All required signals given by hand and arm shall be given in the following manner:

1. Left turn-hand and arm extended horizontally beyond the side of the bicycle.

2. Right turn- left hand and arm extended upward beyond the side of the bicycle or right hand and arm extended horizontally to the right side of the bicycle.

3. Stop or sudden decrease of speed signal- left hand and arm extended downward beyond the side of the bicycle.

VC 23330 - Toll Crossing
Except where a special permit has been obtained from the Department of Transportation, bicycles shall not be permitted on any vehicular crossing, unless the Department by signs indicates that bicycles are permitted upon all or any portion of the vehicular crossing.

VC 27400 - Headsets and Earplugs
No person operating any vehicle, including a bicycle shall wear any headset covering, or any earplugs in, both ears. There are exceptions for persons operating authorized emergency vehicles, special construction or maintenance equipment and refuse collection equipment, and for any person wearing personal hearing protectors designed to attenuate injurious noise levels and which do not inhibit the wearers' ability to hear a siren or horn from an emergency vehicle or horn form another motor vehicle, and for any person using a prosthetic device which aids the hard of hearing.

VC 39002 - License Requirement
a) A city or county may adopt a bicycle licensing ordinance or resolution providing that no resident shall operate any bicycle on any street, road, highway, or other public property within the city of county, unless such bicycle is licensed in accordance with this division.

b) Any bicycle not licensed under this division may be additionally regulated or licensed pursuant to local ordinance or may be licensed upon request of the owner.

c) It is illegal for any person to tamper with, destroy, mutilate or alter any license indicia (marking) or registration form or to remove, alter, or mutilate the serial number, or the identifying marks of a licensing agency's identifying symbol on any bicycle frame licensed under the provision of this division.

VC 23111 - 23112
Throwing Substances On Highways Or Adjoining Areas.

No person in any vehicle shall throw or discharge from or upon any road, highway or adjoining area, pubic or private, any lighted or non-lighted cigarette, cigar, match or any flaming or glowing substance.

No person shall throw or deposit upon a highway any bottle, can, glass, wire, nails, paper or any substance likely to injure or cause damage to traffic using the highway.

Note: Some of the sections of the laws listed above have been reworded slightly and/or abbreviated. For exact language, refer to the referenced sections in the California Vehicle Code.

In addition to these state laws, many communities have local ordinances. Check with local police departments regarding bicycle registration, licensing, and regulations (sidewalk riding, etc.).

Appendix D: Caltrans Highway Design Manual Chapter 1000 – Bikeway Planning and Design

The following pages from the Caltrans *Highway Design Manual* are included as a reference for physical design requirements for bikeways in the State of California.


SHARE
THE
ROAD

CHAPTER 1000 BIKEWAY PLANNING AND DESIGN

Topic 1001 - General Criteria

Index 1001.1 - Introduction

The needs of non-motorized transportation are an essential part of all highway projects. Topic 105 discusses Pedestrian Facilities with Index 105.3 addressing accessibility needs. This chapter discusses bicycle travel. All city, county, regional and other local agencies responsible for bikeways or roads where bicycle travel is permitted must follow the minimum bicycle planning and design criteria contained in this and other chapters of this manual (See Streets and Highways Code Section 891).

Bicycle travel can be enhanced by improved maintenance and by upgrading existing roads used regularly by bicyclists, regardless of whether or not bikeways are designated. This effort requires increased attention to the right-hand portion of roadways where bicyclists are expected to ride. On new construction, and major reconstruction projects, adequate width should be provided to permit shared use by motorists and bicyclists. On resurfacing projects, it is important to provide a uniform surface for bicyclists and pedestrians. See Index 625.1(1) and 635.1(1) for guidance in accommodating bicyclist and pedestrian needs on resurfacing projects. **When adding lanes or turn pockets, a minimum 4-foot shoulder shall be provided (see Topic 405 and Table 302.1).** When feasible, a wider shoulder should be considered. When placing a roadway edge line, sufficient room outside the line should be provided for bicyclists. When considering the restriping of roadways for more traffic lanes, the impact on bicycle travel should be assessed. Bicycle and pedestrian traffic through construction zones should be addressed in the project development process. These efforts, to preserve or improve an area for use by bicyclists, can enhance motorist and bicyclist safety and mobility.

1001.2 The Role of Bikeways

Bikeways are one element of an effort to improve bicycling safety and convenience - either to help accommodate motor vehicle and bicycle traffic on shared roadways, or to complement the road system to meet needs not adequately met by roads.

Off-street bikeways in exclusive corridors can be effective in providing new recreational opportunities, or in some instances, desirable commuter routes. They can also be used to close gaps where barriers exist to bicycle travel (e.g., river crossing). On-street bikeways can serve to enhance safety and convenience, especially if other commitments are made in conjunction with establishment of bikeways, such as: elimination of parking or increasing roadway width, elimination of surface irregularities and roadway obstacles, frequent street sweeping, establishing intersection priority on the bike route street as compared with the majority of cross streets, and installation of bicycle-sensitive loop detectors at signalized intersections.

1001.3 The Decision to Develop Bikeways

The decision to develop bikeways should be made with the knowledge that bikeways are not the solution to all bicycle-related problems. Many of the common problems are related to improper bicyclist and motorist behavior and can only be corrected through effective education and enforcement programs. The development of well conceived bikeways can have a positive effect on bicyclist and motorist behavior. Conversely, poorly conceived bikeways can be counterproductive to education and enforcement programs.

1001.4 Definitions

The Streets and Highway Code Section 890.4 defines a "Bikeway" as a facility that is provided primarily for bicycle travel.

(1) Class I Bikeway (Bike Path). Provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow by motorists minimized.

(2) Class II Bikeway (Bike Lane). Provides a striped lane for one-way bike travel on a street or highway.

(3) Class III Bikeway (Bike Route). Provides for shared use with pedestrian or motor vehicle traffic.

1001.5 Streets and Highways Code References - Chapter 8 - Nonmotorized Transportation

(a) Section 887 -- Definition of nonmotorized facility.

(b) Section 887.6 -- Agreements with local agencies to construct and maintain nonmotorized facilities.

(c) Section 887.8 -- Payment for construction and maintenance of nonmotorized facilities approximately paralleling State highways.

(d) Section 888 -- Severance of existing major nonmotorized route by freeway construction.

(e) Section 888.2 -- Incorporation of non-motorized facilities in the design of freeways.

(f) Section 888.4 -- Requires Caltrans to budget not less than $360,000 annually for nonmotorized facilities used in conjunction with the State highway system.

(g) Section 890.4 -- Class I, II, and III bikeway definitions.

(h) Section 890.6 - 890.8 -- Caltrans and local agencies to develop design criteria and symbols for signs, markers, and traffic control devices for bikeways and roadways where bicycle travel is permitted.

(i) Section 891 -- Local agencies must comply with design criteria and uniform symbols.

(j) Section 892 -- Use of abandoned right-of-way as a nonmotorized facility.

1001.6 Vehicle Code References - Bicycle Operation

(a) Section 21200 -- Bicyclist's rights and responsibilities for traveling on highways.

(b) Section 21202 -- Bicyclist's position on roadways when traveling slower than the normal traffic speed.

(c) Section 21206 -- Allows local agencies to regulate operation of bicycles on pedestrian or bicycle facilities.

(d) Section 21207 -- Allows local agencies to establish bike lanes on non-state highways.

(e) Section 21207.5 -- Prohibits motorized bicycles on bike paths or bike lanes.

(f) Section 21208 -- Specifies permitted movements by bicyclists from bike lanes.

(g) Section 21209 -- Specifies permitted movements by motorists in bike lanes.

(h) Section 21210 -- Prohibits bicycle parking on sidewalks unless pedestrians have an adequate path.

(i) Section 21211 -- Prohibits impeding or obstruction of bicyclists on bike paths.

(j) Section 21717 -- Requires a motorist to drive in a bike lane prior to making a turn.

(k) Section 21960 -- Use of freeways by bicyclists.

Topic 1002 - Bikeway Facilities

1002.1 Selection of the Type of Facility

The type of facility to select in meeting the bicycle need is dependent on many factors, but the following applications are the most common for each type.

(1) Shared Roadway (No Bikeway Designation). Most bicycle travel in the State now occurs on streets and highways without bikeway designations. This probably will be true in the future as well. In some instances, entire street systems may be fully adequate for safe and efficient bicycle travel, and signing and pavement marking for bicycle use may be unnecessary. In other cases, prior to designation as a bikeway, routes may need improvements for bicycle travel.

Many rural highways are used by touring bicyclists for intercity and recreational travel. It might be inappropriate to designate the highways as bikeways because of the limited use and the lack of continuity with other bike routes. However, the development and

maintenance of 4-foot paved roadway shoulders with a standard 4 inch edge line can significantly improve the safety and convenience for bicyclists and motorists along such routes.

(2) *Class I Bikeway (Bike Path)*. Generally, bike paths should be used to serve corridors not served by streets and highways or where wide right of way exists, permitting such facilities to be constructed away from the influence of parallel streets. Bike paths should offer opportunities not provided by the road system. They can either provide a recreational opportunity, or in some instances, can serve as direct high-speed commute routes if cross flow by motor vehicles and pedestrian conflicts can be minimized. The most common applications are along rivers, ocean fronts, canals, utility right of way, abandoned railroad right of way, within college campuses, or within and between parks. There may also be situations where such facilities can be provided as part of planned developments. Another common application of Class I facilities is to close gaps to bicycle travel caused by construction of freeways or because of the existence of natural barriers (rivers, mountains, etc.).

(3) *Class II Bikeway (Bike Lane)*. Bike lanes are established along streets in corridors where there is significant bicycle demand, and where there are distinct needs that can be served by them. The purpose should be to improve conditions for bicyclists in the corridors. Bike lanes are intended to delineate the right of way assigned to bicyclists and motorists and to provide for more predictable movements by each. But a more important reason for constructing bike lanes is to better accommodate bicyclists through corridors where insufficient room exists for safe bicycling on existing streets. This can be accomplished by reducing the number of lanes, reducing lane width, or prohibiting parking on given streets in order to delineate bike lanes. In addition, other things can be done on bike lane streets to improve the situation for bicyclists, that might not be possible on all streets (e.g., improvements to the surface, augmented sweeping programs, special signal facilities, etc.). Generally, pavement markings alone will not measurably enhance bicycling.

If bicycle travel is to be controlled by delineation, special efforts should be made to assure that high levels of service are provided with these lanes.

In selecting appropriate streets for bike lanes, location criteria discussed in the next section should be considered.

(4) *Class III Bikeway (Bike Route)*. Bike routes are shared facilities which serve either to:

(a) Provide continuity to other bicycle facilities (usually Class II bikeways); or

(b) Designate preferred routes through high demand corridors.

As with bike lanes, designation of bike routes should indicate to bicyclists that there are particular advantages to using these routes as compared with alternative routes. This means that responsible agencies have taken actions to assure that these routes are suitable as shared routes and will be maintained in a manner consistent with the needs of bicyclists. Normally, bike routes are shared with motor vehicles. The use of sidewalks as Class III bikeways is strongly discouraged.

It is emphasized that the designation of bikeways as Class I, II and III should not be construed as a hierarchy of bikeways; that one is better than the other. Each class of bikeway has its appropriate application.

In selecting the proper facility, an overriding concern is to assure that the proposed facility will not encourage or require bicyclists or motorists to operate in a manner that is inconsistent with the rules of the road.

An important consideration in selecting the type of facility is continuity. Alternating segments of Class I and Class II (or Class III) bikeways along a route are generally incompatible, as street crossings by bicyclists are required when the route changes character. Also, wrong-way bicycle travel will occur on the street beyond the ends of bike paths because of the inconvenience of having to cross the street.

Topic 1003 - Design Criteria

1003.1 Class I Bikeways

Class I bikeways (bike paths) are facilities with exclusive right of way, with cross flows by motorists minimized. Section 890.4 of the Streets and Highways Code describes Class I bikeways as serving "the exclusive use of bicycles and pedestrians". However, experience has shown that if significant pedestrian use is anticipated, separate facilities for pedestrians are necessary to minimize conflicts. Dual use by pedestrians and bicycles is undesirable, and the two should be separated wherever possible.

Sidewalk facilities are not considered Class I facilities because they are primarily intended to serve pedestrians, generally cannot meet the design standards for Class I bikeways, and do not minimize motorist cross flows. See Index 1003.3 for discussion relative to sidewalk bikeways.

By State law, motorized bicycles ("mopeds") are prohibited on bike paths unless authorized by ordinance or approval of the agency having jurisdiction over the path. Likewise, all motor vehicles are prohibited from bike paths. These prohibitions can be strengthened by signing.

(1) Widths. **The minimum paved width for a two-way bike path shall be 8 feet. The minimum paved width for a one-way bike path shall be 5 feet. A minimum 2-foot wide graded area shall be provided adjacent to the pavement (see Figure 1003.1A).** A 3-foot graded area is recommended to provide clearance from poles, trees, walls, fences, guardrails, or other lateral obstructions. A wider graded area can also serve as a jogging path. Where the paved width is wider than the minimum required, the graded area may be reduced accordingly; however, the graded area is a desirable feature regardless of the paved width. Development of a one-way bike path should be undertaken only after careful consideration due to the problems of enforcing one-way operation and the difficulties in maintaining a path of restricted width.

Where heavy bicycle volumes are anticipated and/or significant pedestrian traffic is expected, the paved width of a two-way path should be greater than 8-feet, preferably 12 feet or more. Another important factor to consider in determining the appropriate width is that bicyclists will tend to ride side by side on bike paths, necessitating more width for safe use.

Experience has shown that paved paths less than 12 feet wide sometimes break up along the edge as a result of loads from maintenance vehicles.

Where equestrians are expected, a separate facility should be provided.

(2) Clearance to Obstructions. **A minimum 2-foot horizontal clearance to obstructions shall be provided adjacent to the pavement (see Figure 1003.1A).** A 3-foot clearance is recommended. Where the paved width is wider than the minimum required, the clearance may be reduced accordingly; however, an adequate clearance is desirable regardless of the paved width. If a wide path is paved contiguous with a continuous fixed object (e.g., block wall), a 4-inch white edge line, 2 feet from the fixed object, is recommended to minimize the likelihood of a bicyclist hitting it**. The clear width on structures between railings shall be not less than 8 feet.** It is desirable that the clear width of structures be equal to the minimum clear width of the path (i.e., 12 feet).

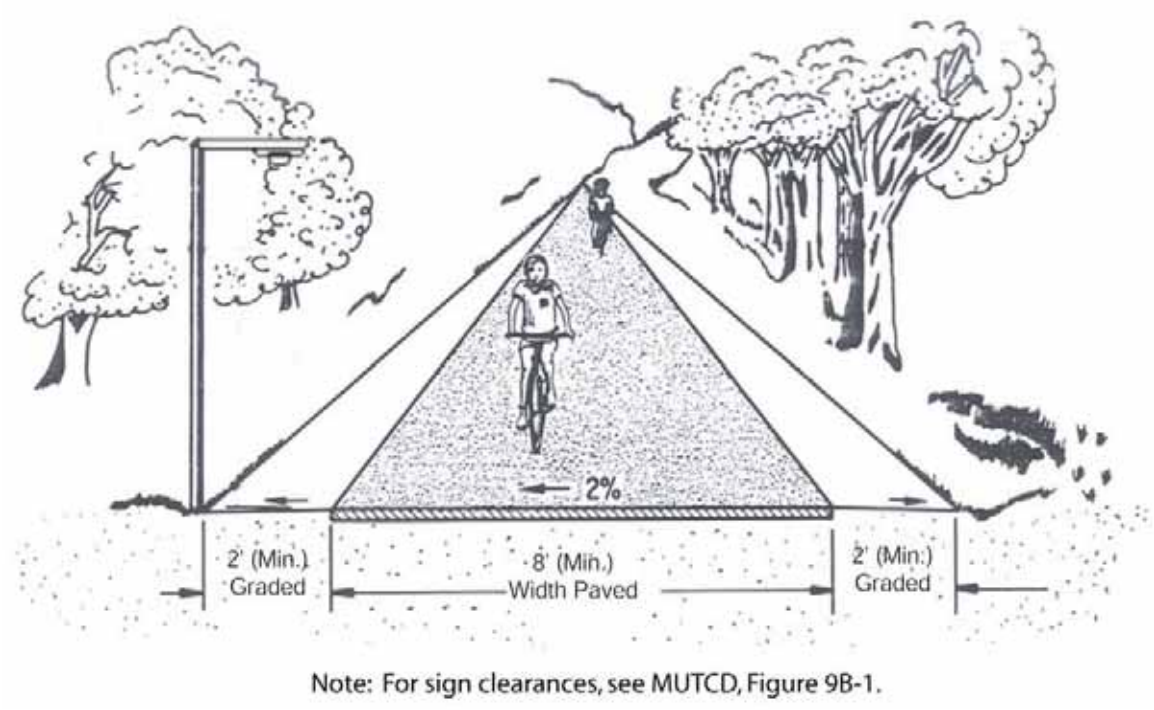
The vertical clearance to obstructions across the clear width of the path shall be a minimum of 8 feet. Where practical, a vertical clearance of 10 feet is desirable.

(3) Signing and Delineation. For application and placement of signs, see the Manual on Uniform Traffic Control Devices (MUTCD), Section 9B.01 and the MUTCD and California Supplement Section 9B.01 and Figure 9B-101. For pavement marking guidance, see the MUTCD, Section 9C.03.

(4) Intersections with Highways. Intersections are a prime consideration in bike path design. If alternate locations for a bike path are available, the one with the most favorable intersection conditions should be selected.

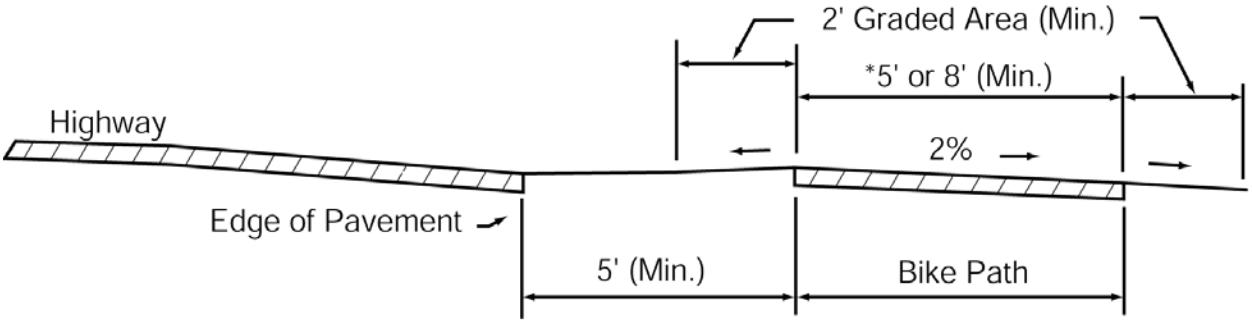
Figure 1003.1A

Two-Way Bike Path on Separate Right of Way



Note: For sign clearances, see MUTCD, Figure 9B-1.

Figure 1003.1B
Typical Cross Section of Bike Path Along Highway



NOTE: See Index 1003.1(5)

*One - Way: 5' Minimum Width
Two - Way: 8' Minimum Width

Where motor vehicle cross traffic and bicycle traffic is heavy, grade separations are desirable to eliminate intersection conflicts. Where grade separations are not feasible, assignment of right of way by traffic signals should be considered. Where traffic is not heavy, stop or yield signs for bicyclists may suffice.

Bicycle path intersections and approaches should be on relatively flat grades. Stopping sight distances at intersections should be checked and adequate warning should be given to permit bicyclists to stop before reaching the intersection, especially on downgrades.

When crossing an arterial street, the crossing should either occur at the pedestrian crossing, where motorists can be expected to stop, or at a location completely out of the influence of any intersection to permit adequate opportunity for bicyclists to see turning vehicles. When crossing at midblock locations, right of way should be assigned by devices such as yield signs, stop signs, or traffic signals which can be activated by bicyclists. Even when crossing within or adjacent to the pedestrian crossing, stop or yield signs for bicyclists should be placed to minimize potential for conflict resulting from turning autos. Where bike path stop or yield signs are visible to approaching motor vehicle traffic, they should be shielded to avoid confusion. In some cases, Bike Xing signs may be placed in advance of the crossing to alert motorists. Ramps should be installed in the curbs, to preserve the utility of the bike path. Ramps should be the same width as the bicycle paths. Curb cuts and ramps should provide a smooth transition between the bicycle paths and the roadway.

(5) Separation Between Bike Paths and Highways. A wide separation is recommended between bike paths and adjacent highways (see Figure 1003.1B). **Bike paths closer than 5 feet from the edge of the shoulder shall include a physical barrier to prevent bicyclists from encroaching onto the highway. Bike paths within the clear recovery zone of freeways shall include a physical barrier separation.** Suitable barriers could include chain link fences or dense shrubs. Low barriers (e.g., dikes, raised traffic bars) next to a highway are not recommended because bicyclists could fall over them and into oncoming automobile traffic. In instances where there is danger of motorists encroaching into the bike path, a positive barrier (e.g., concrete barrier, steel guardrailing) should be provided. See Index 1003.6 for criteria relative to bike paths carried over highway bridges.

Bike paths immediately adjacent to streets and highways are not recommended. They should not be considered a substitute for the street, because many bicyclists will find it less convenient to ride on these types of facilities as compared with the streets, particularly for utility trips.

(6) Bike Paths in the Median of Highways. As a general rule, bike paths in the median of highways are not recommended because they require movements contrary to normal rules of the road. Specific problems with such facilities include:

(a) Bicyclist right turns from the center of roadways are unnatural for bicyclists and confusing to motorists.

(b) Proper bicyclist movements through intersections with signals are unclear.

(c) Left-turning motorists must cross one direction of motor vehicle traffic and two directions of bicycle traffic, which increases conflicts.

(d) Where intersections are infrequent, bicyclists will enter or exit bike paths at midblock.

(e) Where medians are landscaped, visual relationships between bicyclists and motorists at intersections are impaired.

For the above reasons, bike paths in the median of highways should be considered only when the above problems can be avoided. **Bike paths shall not be designed in the medians of freeways or expressways.**

(7) Design Speed. The proper design speed for a bike path is dependent on the expected type of use and on the terrain. **The minimum design speed for bike paths shall be 25 miles per hour except as noted in Table 1003.1.**

Table 1003.1

Bike Path Design Speeds

Type of Facility	Design Speed (mph)
Bike Paths with Mopeds Prohibited	25
Bike Paths with Mopeds Permitted	30
Bike Paths on Long Downgrades (steeper than 4%, and longer than 500')	30

Installation of "speed bumps" or other similar surface obstructions, intended to cause bicyclists to slow down in advance of intersections or other geometric constraints, shall not be used. These devices cannot compensate for improper design.

(8) Horizontal Alignment and Superelevation. The minimum radius of curvature negotiable by a bicycle is a function of the superelevation rate of the bicycle path surface, the coefficient of friction between the bicycle tires and the bicycle path surface, and the speed of the bicycle.

For most bicycle path applications the superelevation rate will vary from a minimum of 2 percent (the minimum necessary to encourage adequate drainage) to a maximum of approximately 5 percent (beyond which maneuvering difficulties by slow bicyclists and adult tricyclists might be expected). A straight 2 percent cross slope is recommended on tangent sections. The minimum superelevation rate of 2 percent will be adequate for most conditions and will simplify construction. Superelevation rates steeper than 5 percent should be avoided on bike paths expected to have adult tricycle traffic.

The coefficient of friction depends upon speed; surface type, roughness, and condition; tire type and condition; and whether the surface is wet or dry. Friction factors used for design should be selected based upon the point at which centrifugal force causes the bicyclist to recognize a feeling of discomfort and instinctively act to avoid higher speed. Extrapolating from values used in highway design, design friction factors for paved bicycle paths can be assumed to vary from 0.31 at 12 miles per hour to 0.21 at 30 miles per hour. Although there is no data available for unpaved surfaces, it is suggested that friction factors be reduced by 50 percent to allow a sufficient margin of safety.

The minimum radius of curvature can be selected from Figure 1003.1C. When curve radii smaller than those shown in Figure 1003.1C must be used on bicycle paths because of right of way, topographical or other considerations, standard curve warning signs and supplemental pavement markings should be installed. The negative effects of nonstandard curves can also be partially offset by widening the pavement through the curves.

(9) Stopping Sight Distance. To provide bicyclists with an opportunity to see and react to the unexpected, a bicycle path should be designed with adequate stopping sight distances. The distance required to bring a bicycle to a full controlled stop is a function of the bicyclist's perception and brake reaction time, the initial speed of the bicycle, the coefficient of friction between the tires and the pavement, and the braking ability of the bicycle.

Figures 1003.1D and 1003.1E indicate the minimum stopping sight distances for various design speeds and grades. For two-way bike paths, the descending direction, that is, where "G" is negative, will control the design.

(10) Length of Crest Vertical Curves. Figure 1003.1F indicates the minimum lengths of crest vertical curves for varying design speeds.

(11) Lateral Clearance on Horizontal Curves. Figure 1003.1G indicates the minimum clearances to line of sight obstructions for horizontal curves. The required lateral clearance is obtained by entering Figure 1003.1G with the stopping sight distance from Figures 1003.1D and 1003.1E, the proposed horizontal curve radius.

Figure 1003.1C

Curve Radii & Superelevations

$$R = \frac{V^2}{15(0.01e + f)}$$

where,

R = Minimum radius of curvature (ft)

V = Design Speed (mph)

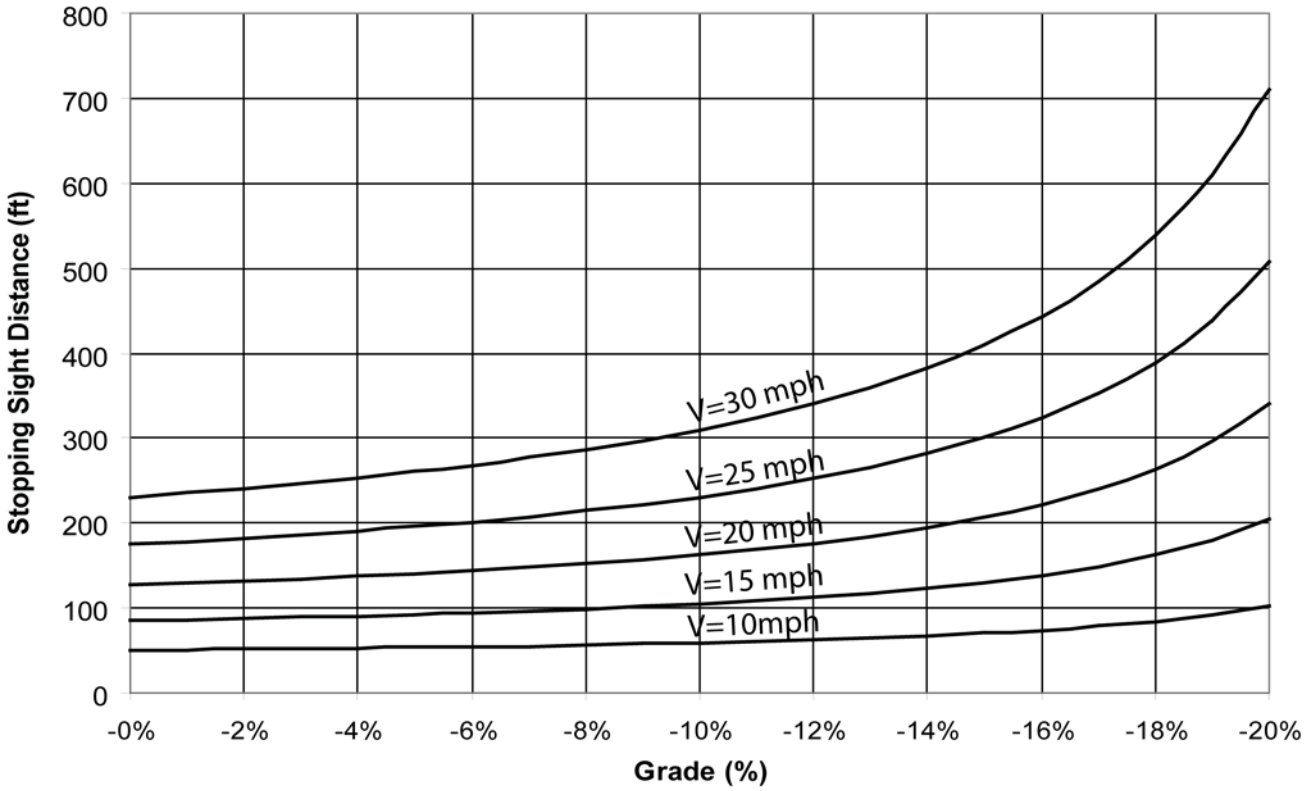
e = Rate of bikeway superelevation, percent

f = Coefficient of friction

Design Speed-V (mph)	Friction Factor-f	Superelevation-e (%)	Minimum Radius-R (ft)
15	0.31	2	46
20	0.28	2	89
25	0.25	2	155
30	0.21	2	261
15	0.31	3	45
20	0.28	3	86
25	0.25	3	149
30	0.21	3	250
15	0.31	4	43
20	0.28	4	84
25	0.25	4	144
30	0.21	4	240
15	0.31	5	42
20	0.28	5	81
25	0.25	5	139
30	0.21	5	231

Figure 1003.1D

Stopping Sight Distance – Descending Grade



$$S = \frac{V^2}{30(f - G)} + 3.67V$$

Where : S = Stopping sight distance (ft)

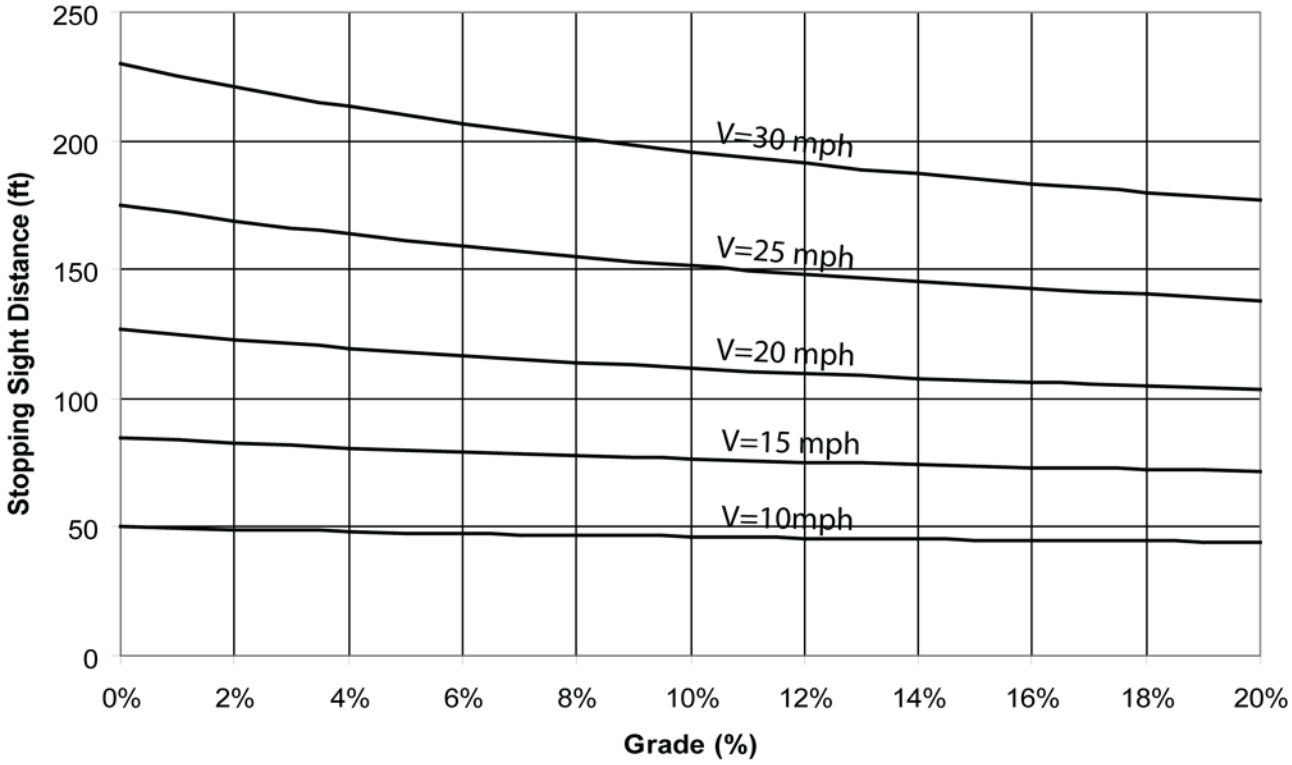
V = Velocity (mph)

f = Coefficient of friction (use 0.25)

G = Grade (ft/ft) rise/run

Figure 1003.1E

Stopping Sight Distance – Ascending Grade



$$S = \frac{V^2}{30(f + G)} + 3.67V$$

Where : S = Stopping sight distance (ft)

V = Velocity (mph)

f = Coefficient of friction (use 0.25)

G = Grade (ft/ft) rise/run

Bicyclists frequently ride abreast of each other on bicycle paths, and on narrow bicycle paths, bicyclists have a tendency to ride near the middle of the path. For these reasons, and because of the serious consequences of a head on bicycle accident, lateral clearances on horizontal curves should be calculated based on the sum of the stopping sight distances for bicyclists traveling in opposite directions around the curve. Where this is not possible or feasible, consideration should be given to widening the path through the curve, installing a yellow center line, installing a curve warning sign, or some combination of these alternatives.

(12) Grades. Bike paths generally attract less skilled bicyclists, so it is important to avoid steep grades in their design. Bicyclists not physically conditioned will be unable to negotiate long, steep uphill grades. Since novice bicyclists often ride poorly maintained bicycles, long downgrades can cause problems. For these reasons, bike paths with long, steep grades will generally receive very little use. The maximum grade rate recommended for bike paths is 5 percent. It is desirable that sustained grades be limited to 2 percent if a wide range of riders is to be accommodated. Steeper grades can be tolerated for short segments (e.g., up to about 500 feet). Where steeper grades are necessitated, the design speed should be increased and additional width should be provided for maneuverability.

(13) Pavement Structure. The pavement structure of a bike path should be designed in the same manner as a highway, with consideration given to the quality of the basement soil and the anticipated loads the bikeway will experience. It is important to construct and maintain a smooth riding surface with skid resistant qualities. Principal loads will normally be from maintenance and emergency vehicles. Expansive soil should be given special consideration and will probably require a special pavement structure. A minimum pavement thickness of 2 inches of Hot Mix Asphalt (HMA) is recommended. HMA (as described in Department of Transportation Standard Specifications), with ½ inch maximum aggregate and medium grading is recommended. Consideration should be given to increasing the asphalt content to provide increased pavement life. Consideration should also be given to sterilization of basement soil to preclude possible weed growth through the pavement.

At unpaved highway or driveway crossings of bicycle paths, the highway or driveway should be paved a minimum of 10 feet on each side of the crossing to reduce the amount of gravel being scattered along the path by motor vehicles. The pavement structure at the crossing should be adequate to sustain the expected loading at that location.

(14) Drainage. For proper drainage, the surface of a bike path should have a cross slope of 2 percent. Sloping in one direction usually simplifies longitudinal drainage design and surface construction, and accordingly is the preferred practice. Ordinarily, surface drainage from the path will be adequately dissipated as it flows down the gently sloping shoulder. However, when a bike path is constructed on the side of a hill, a drainage ditch of suitable dimensions may be necessary on the uphill side to intercept the hillside drainage. Where necessary, catch basins with drains should be provided to carry intercepted water across the path. Such ditches should be designed in such a way that no undue obstacle is presented to bicyclists.

Culverts or bridges are necessary where a bike path crosses a drainage channel.

(15) Barrier Posts. It may be necessary to install barrier posts at entrances to bike paths to prevent motor vehicles from entering. For barrier post placement, visibility marking, and pavement markings, see the MUTCD and California Supplement, Section 9C.101.

Generally, barrier configurations that preclude entry by motorcycles present safety and convenience problems for bicyclists. Such devices should be used only where extreme problems are encountered.

Figure 1003.1F

Minimum Length of Crest Vertical Curve (L) Based on Stopping Sight Distance (S)

$L = 2S - \frac{1456}{A}$ when S > L

$L = \frac{AS^2}{1456}$ when S < L

Double line represents S = L

L = Minimum length of vertical curve – feet

A = Algebraic grade difference - %

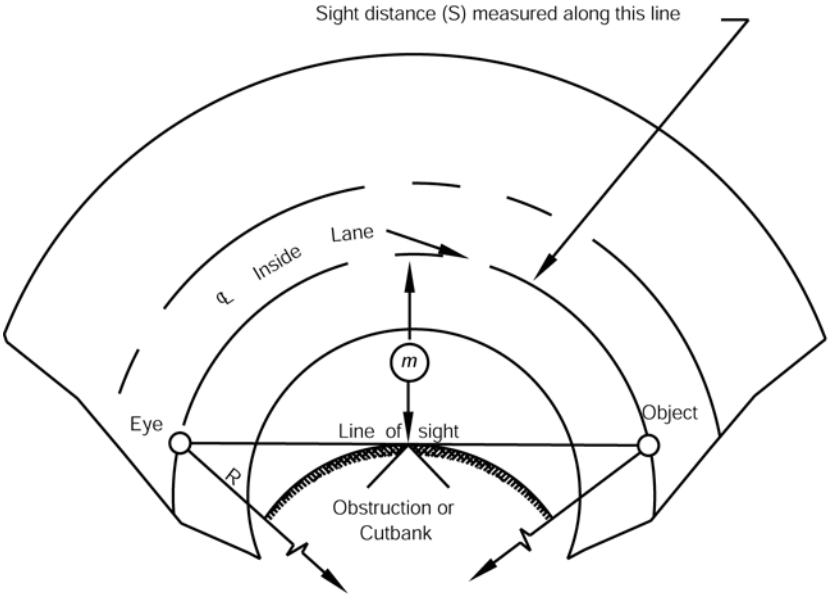
S = Stopping sight distance – feet

Refer to Figure 1003.1D to determine "S", for a given design speed "V"

Height of cyclist eye = 4½ feet Height of object = 4 inches

A	S = Stopping Sight Distance (ft)														
(%)	30	50	70	90	110	130	150	170	190	210	230	250	270	290	
3												15	55	95	
4									16	56	96	136	176	216	
5							9	49	89	129	169	209	249	289	
6		**S > L**				17	57	97	137	177	217	258	300	347	
7					12	52	92	132	172	212	254	300	350	404	
8					38	78	118	158	198	242	291	343	401	462	
9				18	58	98	138	179	223	273	327	386	451	520	
10				34	74	114	155	198	248	303	363	429	501	578	
11			8	48	88	128	170	218	273	333	400	472	551	635	
12			19	59	99	139	185	238	298	363	436	515	601	693	
13			28	68	108	151	201	258	322	394	472	558	651	751	
14			36	76	116	163	216	278	347	424	509	601	701	809	
15		3	43	83	125	174	232	298	372	454	545	644	751	866	
16		9	49	89	133	186	247	318	397	485	581	687	801	924	
17		14	54	95	141	197	263	337	421	515	618	730	851	982	
18		19	59	100	150	209	278	357	446	545	654	773	901	1040	
19		23	63	106	158	221	294	377	471	575	690	816	951	1097	**S < L**
20		27	67	111	166	232	309	397	496	606	727	859	1001	1155	
21		31	71	117	175	244	325	417	521	636	763	901	1051	1213	
22		34	74	122	183	255	340	437	545	666	799	944	1102	1271	
23		37	77	128	191	267	355	457	570	697	836	987	1152	1329	
24		39	81	134	199	279	371	476	595	727	872	1030	1202	1386	
25	2	42	84	139	208	290	386	496	620	757	908	1073	1252	1444	

Figure 1003.1G
Minimum Lateral Clearance (*m*) on Horizontal Curves



S = Sight distance in feet.
R = Radius of ℄ of lane in feet.
m = Distance from ℄ of lane in feet.

See Figure 1003.1D to determine "S" for a given design speed "V".

Angle is expressed in degrees

$$m = R\left[1-\cos\left(\frac{28.65S}{R}\right)\right]$$

$$S = \frac{R}{28.65S}\left[\cos^{-1}\left(\frac{R-m}{R}\right)\right]$$

Formula applies only when S is equal to or less than length of curve.

Line of sight is 28" above ℄ inside lane at point of obstruction.

R (ft)	S = Stopping Sight Distance (ft)														
	20	**40**	**60**	**80**	**100**	**120**	**140**	**160**	**180**	**200**	**220**	**240**	**260**	**280**	**300**
25	2.0	7.6	15.9												
50	1.0	3.9	8.7	15.2	23.0	31.9	41.5								
75	0.7	2.7	5.9	10.4	16.1	22.8	30.4	38.8	47.8	57.4	67.2				
95	0.5	2.1	4.7	8.3	12.9	18.3	24.7	31.8	39.5	48.0	56.9	66.3	75.9	85.8	
125	0.4	1.6	3.6	6.3	9.9	14.1	19.1	24.7	31.0	37.9	45.4	53.3	61.7	70.6	79.7
155	0.3	1.3	2.9	5.1	8.0	11.5	15.5	20.2	25.4	31.2	37.4	44.2	51.4	59.1	67.1
175	0.3	1.1	2.6	4.6	7.1	10.2	13.8	18.0	22.6	27.8	33.5	39.6	46.1	53.1	60.5
200	0.3	1.0	2.2	4.0	6.2	8.9	12.1	15.8	19.9	24.5	29.5	34.9	40.8	47.0	53.7
225	0.2	0.9	2.0	3.5	5.5	8.0	10.8	14.1	17.8	21.9	26.4	31.3	36.5	42.2	48.2
250	0.2	0.8	1.8	3.2	5.0	7.2	9.7	12.7	16.0	19.7	23.8	28.3	33.1	38.2	43.7
275	0.2	0.7	1.6	2.9	4.5	6.5	8.9	11.6	14.6	18.0	21.7	25.8	30.2	34.9	39.9
300	0.2	0.7	1.5	2.7	4.2	6.0	8.1	10.6	13.4	16.5	19.9	23.7	27.7	32.1	36.7
350	0.1	0.6	1.3	2.3	3.6	5.1	7.0	9.1	11.5	14.2	17.1	20.4	23.9	27.6	31.7
390	0.1	0.5	1.2	2.1	3.2	4.6	6.3	8.2	10.3	12.8	15.4	18.3	21.5	24.9	28.5
500	0.1	0.4	0.9	1.6	2.5	3.6	4.9	6.4	8.1	10.0	12.1	14.3	16.8	19.5	22.3
565		0.4	0.8	1.4	2.2	3.2	4.3	5.7	7.2	8.8	10.7	12.7	14.9	17.3	19.8
600		0.3	0.8	1.3	2.1	3.0	4.1	5.3	6.7	8.3	10.1	12.0	14.0	16.3	18.7
700		0.3	0.6	1.1	1.8	2.6	3.5	4.6	5.8	7.1	8.6	10.3	12.0	14.0	16.0
800		0.3	0.6	1.0	1.6	2.2	3.1	4.0	5.1	6.2	7.6	9.0	10.5	12.2	14.4
900		0.2	0.5	0.9	1.4	2.0	2.7	3.6	4.5	5.6	6.7	8.0	9.4	10.9	12.5
1000		0.2	0.5	0.8	1.3	1.8	2.4	3.2	4.0	5.0	6.0	7.2	8.4	9.8	11.2

(16) Lighting. Fixed-source lighting reduces conflicts along paths and at intersections. In addition, lighting allows the bicyclist to see the bicycle path direction, surface conditions, and obstacles. Lighting for bicycle paths is important and should be considered where riding at night is expected, such as bicycle paths serving college students or commuters, and at highway intersections. Lighting should also be considered through underpasses or tunnels, and when nighttime security could be a problem.

Depending on the location, average maintained horizontal illumination levels of 5 lux to 22 lux should be considered. Where special security problems exist, higher illumination levels may be considered. Light standards (poles) should meet the recommended horizontal and vertical clearances. Luminaires and standards should be at a scale appropriate for a pedestrian or bicycle path.

1003.2 Class II Bikeways

Class II bikeways (bike lanes) for preferential use by bicycles are established within the paved area of highways. Bike lane pavement markings are intended to promote an orderly flow of traffic, by establishing specific lines of demarcation between areas reserved for bicycles and lanes to be occupied by motor vehicles. This effect is supported by bike lane signs and pavement markings. Bike lane pavement markings can increase bicyclists' confidence that motorists will not stray into their path of travel if they remain within the bike lane. Likewise, with more certainty as to where bicyclists will be, passing motorists are less apt to swerve toward opposing traffic in making certain they will not hit bicyclists.

Class II bike lanes shall be one-way facilities. Two-way bike lanes (or bike paths that are contiguous to the roadway) are not permitted, as such facilities have proved unsatisfactory and promote riding against the flow of motor vehicle traffic.

(1) Widths. Typical Class II bikeway configurations are illustrated in Figure 1003.2A and are described below:

(a) Figure 1003.2A-(1) depicts bike lanes on an urban type curbed street where parking stalls (or continuous parking stripes) are marked. Bike lanes are located between the parking area and the traffic lanes. **As indicated, 5 feet shall be the minimum width of bike lane where parking stalls are marked.** If parking volume is substantial or turnover high, an additional 1 foot to 2-foot of width is desirable.

Bike lanes shall not be placed between the parking area and the curb. Such facilities increase the conflict between bicyclists and opening car doors and reduce visibility at intersections. Also, they prevent bicyclists from leaving the bike lane to turn left and cannot be effectively maintained.

(b) Figure 1003.2A-(2) depicts bike lanes on an urban-type curbed street, where parking is permitted, but without parking stripe or stall marking. Bike lanes are established in conjunction with the parking areas**. As indicated, 11 feet or 12 feet (depending on the type of curb) shall be the minimum width of the bike lane where parking is permitted.** This type of lane is satisfacory where parking is not extensive and where turnover of parked cars is infrequent. However, if parking is substantial, turnover of parked cars is high, truck traffic is substantial, or if vehicle speeds exceed 35 miles per hour, additional width is recommended.

(c) Figure 1003.2A-(3) depicts bike lanes along the outer portions of an urban type curbed street, where parking is prohibited. This is generally the most desirable configuration for bike lanes, as it eliminates potential conflicts resulting from auto parking (e.g., opening car doors). **As indicated, if no gutter exists, the minimum bike lane width shall be 4 feet. With a normal 2-foot gutter, the minimum bike lane width shall be 5 feet.** The intent is to provide a minimum 4 feet wide bike lane, but with at least 3 feet between the traffic lane and the longitudinal joint at the concrete gutter, since the gutter reduces the effective width of the bike lane for two reasons. First, the longitudinal joint may not always be smooth, and may be difficult

to ride along. Secondly, the gutter does not provide a suitable surface for bicycle travel. Where gutters are wide (say, 4 feet), an additional 3 feet must be provided because bicyclists should not be expected to ride in the gutter. Wherever possible, the width of bike lanes should be increased 6 feet to 8 feet to provide for greater safety. Eight-foot bike lanes can also serve as emergency parking areas for disabled vehicles.

Striping bike lanes next to curbs where parking is prohibited only during certain hours shall be done only in conjunction with special signing to designate the hours bike lanes are to be effective. Since the Vehicle Code requires bicyclists to ride in bike lanes where provided (except under certain conditions), proper signing is necessary to inform bicyclists that they are required to ride in bike lanes only during the course of the parking prohibition. This type of bike lane should be considered only if the vast majority of bicycle travel would occur during the hours of the parking prohibition, and only if there is a firm commitment to enforce the parking prohibition. Because of the obvious complications, this type of bike lane is not encouraged for general application.

Figure 1003.2A-(4) depicts bike lanes on a highway without curbs and gutters. This location is in an undeveloped area where infrequent parking is handled off the pavement. This can be accomplished by supplementing the bike lane signing with R25 (park off pavement) signs, or R26 (no parking) signs. **Minimum widths shall be as shown.** Additional width is desirable, particularly where motor vehicle speeds exceed 35 miles per hour

Per Topic 301, the minimum lane width standard is 12 feet. There are situations where it may be desirable to reduce the width of the traffic lanes in order to add or widen bicycle lanes or shoulders. In determining the appropriateness of narrower traffic lanes, consideration should be given to factors such as motor vehicle speeds, truck volumes, alignment, bicycle lane width, sight distance, and the presence of on-street vehicle parking. When vehicle parking is permitted adjacent to a bicycle lane, or on a shoulder where bicycling is not prohibited, reducing the width of the adjacent traffic lane may allow for wider bicycle lanes or shoulders, to provide greater clearance between bicyclists and driver-side doors when opened. Where favorable conditions exist, traffic lanes of 11 feet may be feasible but must be approved per Topic 301.

Bike lanes are not advisable on long, steep downgrades, where bicycle speeds greater than 30 miles per hour are expected. As grades increase, downhill bicycle speeds will increase, which increases the problem of riding near the edge of the roadway. In such situations, bicycle speeds can approach those of motor vehicles, and experienced bicyclists will generally move into the motor vehicle lanes to increase sight distance and maneuverability. If bike lanes are to be marked, additional width should be provided to accommodate higher bicycle speeds.

If the bike lanes are to be located on one-way streets, they should be placed on the right side of the street. Bike lanes on the left side would cause bicyclists and motorists to undertake crossing maneuvers in making left turns onto a two-way street.

(2) Signing and Pavement Markings. Details for signing and pavement marking of Class II bikeways are found in the MUTCD and California Supplement, Section 9C.04.

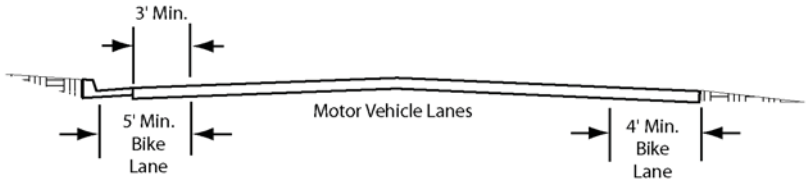
(3) At-grade Intersection Design. Most auto/bicycle accidents occur at intersections. For this reason, bikeway design at intersections should be accomplished in a manner that will minimize confusion by motorists and bicyclists, and will permit both to operate in accordance with the normal rules of the road.

Figure 1003.2A
Typical Bike Lane Cross Sections
(On 2-lane or Multilane Highways)

(1) MARKED PARKING

* 13' is recommended where there is substantial parking or turnover of parked cars is high (e.g. commerical areas).

(2) PARKING PERMITTED WITHOUT MARKED PARKING OR STALL



(With Gutter)

(3) PARKING PROHIBITED

(Without Gutter)

(4) TYPICAL ROADWAY IN OUTLYING AREAS PARKING RESTRICTED

Note: For pavement marking guidance, see the MUTCD and California Supplement, Section 9C.04

Figure 1003.2B illustrates a typical at-grade intersection of multilane streets, with bike lanes on all approaches. Some common movements of motor vehicles and bicycles are shown. A prevalent type of accident involves straight-through bicycle traffic and right-turning motorists. Left-turning bicyclists also have problems, as the bike lane is on the right side of the street, and bicyclists have to cross the path of cars traveling in both directions. Some bicyclists are proficient enough to merge across one or more lanes of traffic, to use the inside lane or left-turn lane. However, there are many who do not feel comfortable making this maneuver. They have the option of making a two-legged left turn by riding along a course similar to that followed by pedestrians, as shown in the diagram. Young children will often prefer to dismount and change directions by walking their bike in the crosswalk.

(4) Interchange Design. As with bikeway design through at-grade intersections, bikeway design through interchanges should be accomplished in a manner that will minimize confusion by motorists and bicyclists. Designers should work closely with the local agency in designing bicycle facilities through interchanges. Local Agencies should carefully select interchange locations which are most suitable for bikeway designations and where the crossing meets applicable design standards. The local agency may have special needs and desires for continuity through interchanges which should be considered in the design process.

For Class II bikeway signing and lane markings, see the MUTCD and California Supplement, Section 9C.04.

The shoulder width shall not be reduced through the interchange area. The minimum shoulder width shall match the approach roadway shoulder width, but not less than 4 feet or 5 feet if a gutter exists. If the shoulder width is not available, the designated bike lane shall end at the previous local road intersection.

Depending on the intersection angles, either Figure 1003.2C or 1003.2D should also be used for multilane ramp intersections. Additionally, the outside through lane should be widened to 14 feet when feasible. This allows extra room for bicycles to share the through lane with vehicles. The outside shoulder width should not be reduced through the interchange area to accommodate this additional width.

1003.3 Class III Bikeways

Class III bikeways (bike routes) are intended to provide continuity to the bikeway system. Bike routes are established along through routes not served by Class I or II bikeways, or to connect discontinuous segments of bikeway (normally bike lanes). Class III facilities are shared facilities, either with motor vehicles on the street, or with pedestrians on sidewalks, and in either case bicycle usage is secondary. Class III facilities are established by placing Bike Route signs along roadways.

Minimum widths for Class III bikeways are not presented, as the acceptable width is dependent on many factors, including the volume and character of vehicular traffic on the road, typical speeds, vertical and horizontal alignment, sight distance, and parking conditions.

Since bicyclists are permitted on all highways (except prohibited freeways), the decision to designate the route as a bikeway should be based on the advisability of encouraging bicycle travel on the route and other factors listed below.

(1) On-street Bike Route Criteria. To be of benefit to bicyclists, bike routes should offer a higher degree of service than alternative streets. Routes should be signed only if some of the following apply:

(a) They provide for through and direct travel in bicycle-demand corridors.

(b) Connect discontinuous segments of bike lanes.

(c) An effort has been made to adjust traffic control devices (stop signs, signals) to give greater priority to bicyclists, as compared with alternative streets. This could include placement of bicycle-sensitive detectors on the right-hand portion of the road, where bicyclists are expected to ride.

Figure 1003.2B

Typical Bicycle/Auto Movements at Intersections of Multilane Streets

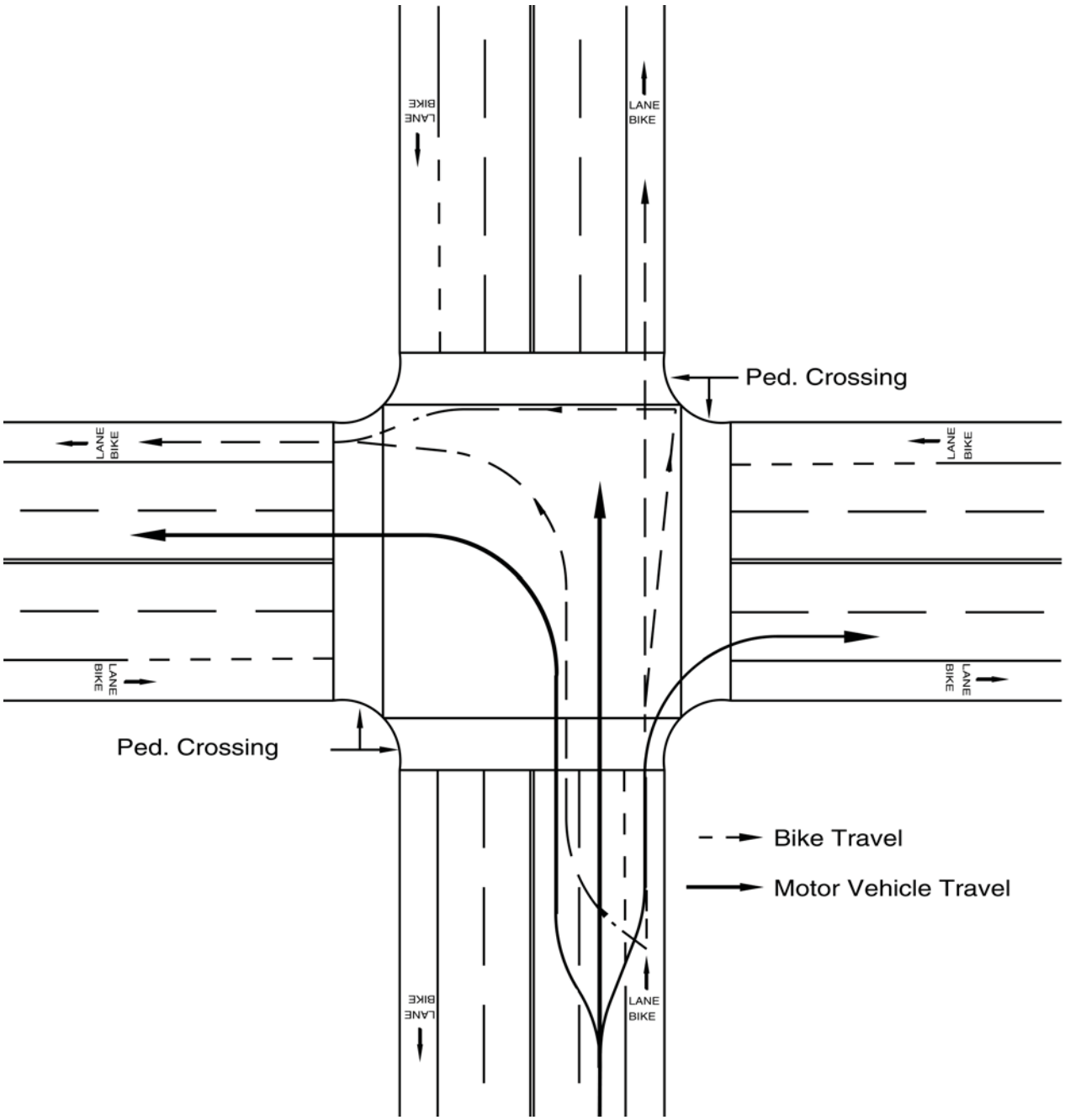
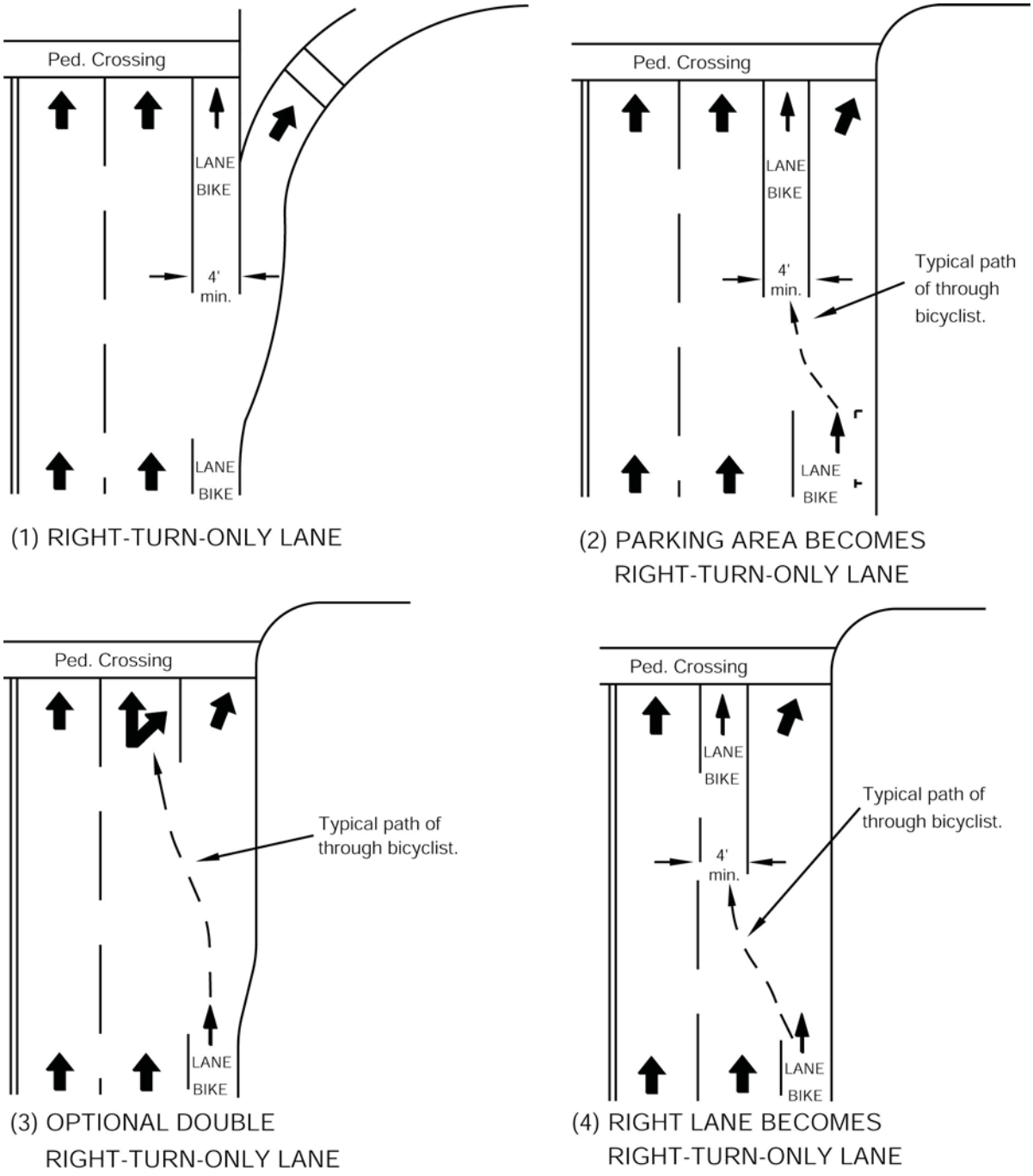
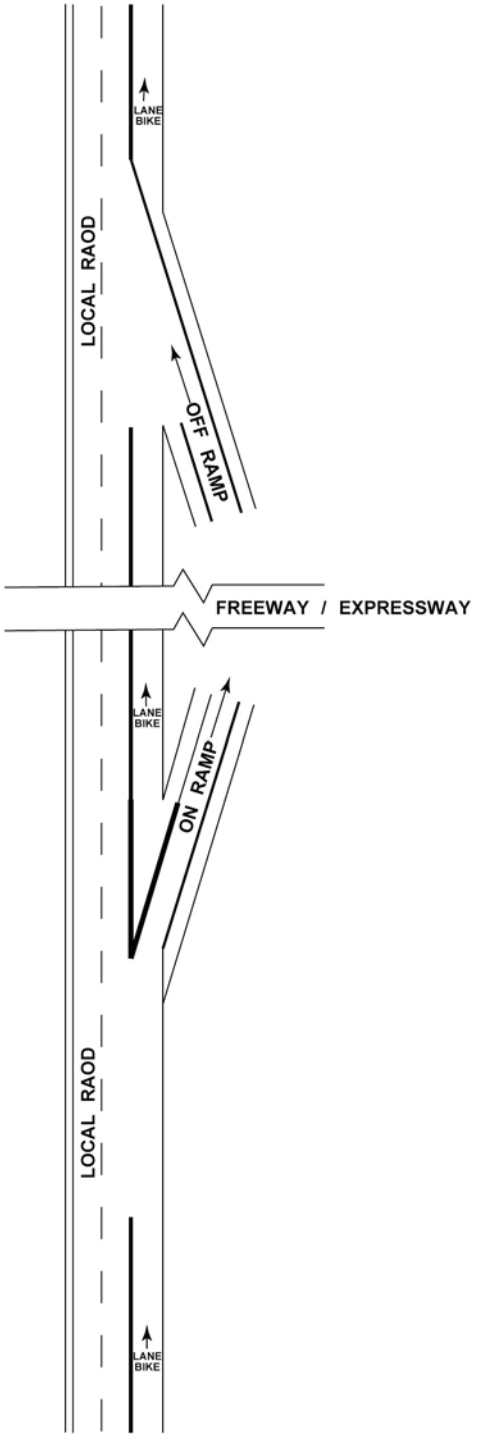


Figure 1003.2C
Bike Lanes Approaching Motorist
Right-turn-only Lane



Note: For bicycle lane markings, see the MUTCD and California Supplement, Section 9C.04.

Figure 1003.2D
Bike Lanes Through Interchanges



Notes:

1.) See Index 1003.2(4) for additional information.

2.) The shoulder width shall not be reduced through the interchange area. The minimum shoulder width shall match the approach roadway shoulder width, but not less than 4 feet or 5 feet if a gutter exists. If the shoulder width is not available, the designated bike lane shall end at the previous local raod intersection.

3.) See Index 1003.3(4) for information on Bike Routes Through Interchanges.

(d) Street parking has been removed or restricted in areas of critical width to provide improved safety.

(e) Surface imperfections or irregularities have been corrected (e.g., utility covers adjusted to grade, potholes filled, etc.).

(f) Maintenance of the route will be at a higher standard than that of other comparable streets (e.g., more frequent street sweeping).

(2) Sidewalk Bikeway Criteria. In general, the designated use of sidewalks (as a Class III bikeway) for bicycle travel is unsatisfactory.

It is important to recognize that the development of extremely wide sidewalks does not necessarily add to the safety of sidewalk bicycle travel, as wide sidewalks will encourage higher speed bicycle use and can increase potential for conflicts with motor vehicles at intersections, as well as with pedestrians and fixed objects.

Sidewalk bikeways should be considered only under special circumstances, such as:

(a) To provide bikeway continuity along high speed or heavily traveled roadways having inadequate space for bicyclists, and uninterrupted by driveways and intersections for long distances.

(b) On long, narrow bridges. In such cases, ramps should be installed at the sidewalk approaches. If approach bikeways are two-way, sidewalk facilities should also be two-way.

Whenever sidewalk bikeways are established, a special effort should be made to remove unnecessary obstacles. Whenever bicyclists are directed from bike lanes to sidewalks, curb cuts should be flush with the street to assure that bicyclists are not subjected to problems associated with crossing a vertical lip at a flat angle. Also curb cuts at each intersection are necessary. Curb cuts should be wide enough to accommodate adult tricycles and two-wheel bicycle trailers.

In residential areas, sidewalk riding by young children too inexperienced to ride in the street is common. With lower bicycle speeds and lower auto speeds, potential conflicts are somewhat lessened, but still exist. Nevertheless, this type of sidewalk bicycle use is accepted. But it is inappropriate to sign these facilities as bikeways. Bicyclists should not be encouraged (through signing) to ride facilities that are not designed to accommodate bicycle travel.

(3) Destination Signing of Bike Routes. For Bike Route signs to be more functional, supplemental plates may be placed beneath them when located along routes leading to high demand destinations (e.g., "To Downtown"; "To State College"; etc. For typical signing, see the MUTCD and California Supplement, Figures 9B-5 and 9B-6.

There are instances where it is necessary to sign a route to direct bicyclists to a logical destination, but where the route does not offer any of the above listed bike route features. In such cases, the route should not be signed as a bike route; however, destination signing may be advisable. A typical application of destination signing would be where bicyclists are directed off a highway to bypass a section of freeway. Special signs would be placed to guide bicyclists to the next logical destination. The intent is to direct bicyclists in the same way as motorists would be directed if a highway detour was necessitated.

(4) Interchange Design As with bikeway design through at-grade intersections, bikeway design through interchanges should be accomplished in a manner that will minimize confusion by motorists and bicyclists. Designers should work closely with the local agency in designing bicycle facilities through interchanges. Local Agencies should carefully select interchange locations which are most suitable for bikeway designations and where the crossing meets applicable design standards. The local agency may have special needs and desires for continuity through interchanges which should be considered in the design process.

Within the Interchange area the bike route shall require either an outside lane width of 16-foot or a 12-foot lane and a 4-foot shoulder. If the above width is not available,

the designated bike route shall end at the previous local road intersection.

1003.4 Bicycles on Freeways

In some instances, bicyclists are permitted on freeways. Seldom would a freeway be designated as a bikeway, but it can be opened for use if it meets certain criteria. Essentially, the criteria involve assessing the safety and convenience of the freeway as compared with available alternate routes. However, a freeway should not be opened to bicycle use if it is determined to be incompatible. The Headquarters Traffic Liaisons and the Design Coordinator must approve any proposals to open freeways to bicyclists.

If a suitable alternate route exists, it would normally be unnecessary to open the freeway. However, if the alternate route is unsuitable for bicycle travel the freeway may be a better alternative for bicyclists. In determining the suitability of an alternate route, safety should be the paramount consideration. The following factors should be considered:

- Number of intersections
- Shoulder widths
- Traffic volumes
- Vehicle speeds
- Bus, truck and recreational vehicle volumes
- Grades
- Travel time

When a suitable alternate route does not exist, a freeway shoulder may be considered for bicycle travel. Normally, freeways in urban areas will have characteristics that make it unfeasible to permit bicycle use. In determining if the freeway shoulder is suitable for bicycle travel, the following factors should be considered;

- Shoulder widths
- Bicycle hazards on shoulders (drainage grates, expansion joints, etc.)
- Number and location of entrance/exit ramps
- Traffic volumes on entrance/exit ramps
- Bridge Railing height

When bicyclists are permitted on segments of freeway, it will be necessary to modify and supplement freeway regulatory signs, particularly those at freeway ramp entrances and exits, see the MUTCD and California Supplement, Section 9B.101.

Where no reasonable alternate route exists within a freeway corridor, the Department should coordinate with local agencies to develop or improve existing routes or provide parallel bikeways within or adjacent to the freeway right of way.

The long term goal is to provide a safe and convenient non-freeway route for bicycle travel.

1003.5 Multipurpose Trails

In some instances, it may be appropriate for agencies to develop multipurpose trails - for hikers, joggers, equestrians, bicyclists, etc. Many of these trails will not be paved and will not meet the standards for Class I bikeways. As such, these facilities should not be signed as bikeways. Rather, they should be designated as multipurpose trails (or similar designation), along with regulatory signing to restrict motor vehicles, as appropriate.

If multipurpose trails are primarily to serve bicycle travel, they should be developed in accordance with standards for Class I bikeways. In general, multipurpose trails are not recommended as high speed transportation facilities for bicyclists because of conflicts between bicyclists and pedestrians. Wherever possible, separate bicycle and pedestrian paths should be provided. If this is not feasible, additional width, signing and pavement markings should be used to minimize conflicts.

It is undesirable to mix mopeds and bicycles on the same facility. In general, mopeds should not be allowed on multipurpose trails because of conflicts with slower moving bicyclists and pedestrians. In some cases where an alternate route for mopeds does not exist, additional width, signing, and pavement markings should be used to minimize conflicts. Increased patrolling by law enforcement personnel is also recommended to enforce speed limits and other rules of the road.

It is usually not desirable to mix horses and bicycle traffic on the same multipurpose trail. Bicyclists are often not aware of the need for slower speeds and additional operating space near horses. Horses

can be startled easily and may be unpredictable if they perceive approaching bicyclists as a danger. In addition, pavement requirements for safe bicycle travel are not suitable for horses. For these reasons, a bridle trail separate from the multipurpose trail is recommended wherever possible.

1003.6 Miscellaneous Bikeway Criteria

The following are miscellaneous bikeway criteria which should be followed to the extent pertinent to Class I, II and III bikeways. Some, by their very nature, will not apply to all classes of bikeway. Many of the criteria are important to consider on any highway where bicycle travel is expected, without regard to whether or not bikeways are established.

(1) Bridges. Bikeways on highway bridges must be carefully coordinated with approach bikeways to make sure that all elements are compatible. For example, bicycle traffic bound in opposite directions is best accommodated by bike lanes on each side of a highway. In such cases, a two-way bike path on one side of a bridge would normally be inappropriate, as one direction of bicycle traffic would be required to cross the highway at grade twice to get to and from the bridge bike path. Because of the inconvenience, many bicyclists will be encouraged to ride on the wrong side of the highway beyond the bridge termini.

The following criteria apply to a two-way bike path on one side of a highway bridge:

(a) The bikeway approach to the bridge should be by way of a separate two-way facility for the reason explained above.

(b) **A physical separation, such as a chain link fence or railing, shall be provided to offset the adverse effects of having bicycles traveling against motor vehicle traffic.** The physical separation should be designed to minimize fixed end hazards to motor vehicles and if the bridge is an interchange structure, to minimize sight distance restrictions at ramp intersections.

It is recommended that bikeway bridge railings or fences placed between traffic lanes and bikeways be at least 54 inches high to minimize the likelihood of bicyclists falling over the railings. Standard bridge railings which are lower than 46 inches can be retrofitted with lightweight upper railings or chain link fence suitable to restrain bicyclists. See Index 208.10(6) for guidance regarding bicycle railing on bridges.

Separate highway overcrossing structures for bikeway traffic shall conform to Department standard pedestrian overcrossing design loading. The minimum clear width shall be the paved width of the approach bikeway but not less than 8 feet. If pedestrians are to use the structure, additional width is recommended.

(2) Surface Quality. The surface to be used by bicyclists should be smooth, free of potholes, and the pavement edge uniform. For rideability on new construction, the finished surface of bikeways should not vary more than ¼ inch from the lower edge of an 8-foot long straight edge when laid on the surface in any direction.

Table 1003.6 indicates the recommended bikeway surface tolerances for Class II and III bikeways developed on existing streets to minimize the potential for causing bicyclists to lose control of their bicycle (Note: Stricter tolerances should be achieved on new bikeway construction.) Shoulder rumble strips are not suitable as a riding surface for bicycles. See the MUTCD and California Supplement, Chapter 3B for additional information regarding rumble strip design considerations for bicycles.

(3) Drainage Grates, Manhole Covers, and Driveways. Drainage inlet grates, manhole covers, etc., on bikeways should be designed and installed in a manner that provides an adequate surface for bicyclists. They should be maintained flush with the surface when resurfacing.

Table 1003.6
Bikeway Surface Tolerances

Direction of Travel	Grooves (1)	Steps (2)
Parallel to travel	No more than ½" wide	No more than ⅜" high
Perpendicular to travel	---	No more than ¾" high

Notes:

(1) Groove--A narrow slot in the surface that could catch a bicycle wheel, such as a gap between two concrete slabs.

(2) Step--A ridge in the pavement, such as that which might exist between the pavement and a concrete gutter or manhole cover; or that might exist between two pavement blankets when the top level does not extend to the edge of the roadway.

Drainage inlet grates on bikeways shall have openings narrow enough and short enough to assure bicycle tires will not drop into the grates (e.g., reticuline type), regardless of the direction of bicycle travel. Where it is not immediately feasible to replace existing grates with standard grates designed for bicycles, 1" x ¼" steel cross straps should be welded to the grates at a spacing of 6 inches to 8 inches on centers to reduce the size of the openings adequately.

Corrective actions described above are recommended on all highways where bicycle travel is permitted, whether or not bikeways are designated.

Future driveway construction should avoid construction of a vertical lip from the driveway to the gutter, as the lip may create a problem for bicyclists when entering from the edge of the roadway at a flat angle. If a lip is deemed necessary, the height should be limited to ½ inch.

(4) At-grade Railroad Crossings and Cattle Guards. Whenever it is necessary to cross railroad tracks with a bikeway, special care must be taken to assure that the safety of bicyclists is protected. The bikeway crossing should be at least as wide as the approaches of the bikeway. Wherever possible, the crossing should be straight and at right angles to the rails. For on-street bikeways where a skew is unavoidable, the shoulder (or bike lane) should be widened, if possible, to permit bicyclists to cross at right angles (see Figure 1003.6A). If this is not possible, special construction and materials should be considered to keep the flangeway depth and width to a minimum.

Pavement should be maintained so ridge buildup does not occur next to the rails. In some cases, timber plank crossings can be justified and can provide for a smoother crossing. Where hazards to bicyclist cannot be avoided, appropriate signs should be installed to warn bicyclists of the danger.

All railroad crossings are regulated by the California Public Utilities Commission (CPUC). All new bike path railroad crossings must be approved by the CPUC. Necessary railroad protection will be determined based on a joint field review involving the applicant, the railroad company, and the CPUC.

The presence of cattle guards along any roadway where bicyclists are expected should be clearly marked with adequate advance warning.

(5) Obstruction Markings. Vertical barriers and obstructions, such as abutments, piers, and other features causing bikeway constriction, should be clearly marked to gain the attention of approaching bicyclists. This treatment should be used only where unavoidable, and is by no means a substitute for good bikeway design. See the MUTCD, Section 9C.06.

Figure 1003.6A
Railroad Crossings